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Review of American Chemical Research.

Vol. 7 (1901)

(Suppl. to Jour. Am. Chem. Soc.)

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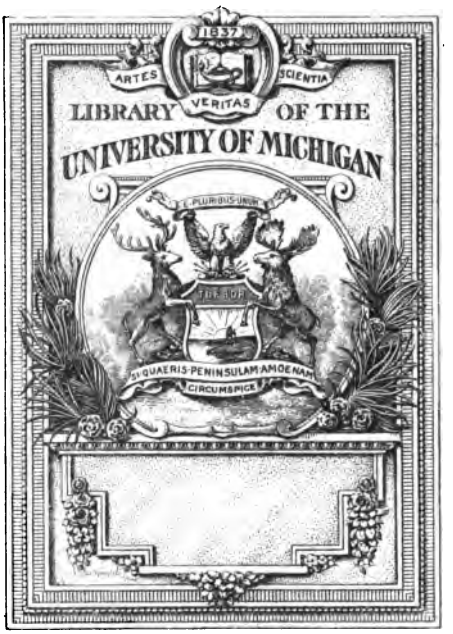

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REVIEW

—OF—

American Chemical Research

1143

VOL. VII. 1901.

Contributed by Members of the Instructing Staff of the Massachusetts Institute of Technology.

ARTHUR A. NOYES, Editor.
A. G. WOODMAN, Associate Editor.

REVIEWERS.

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EASTON, PA.:
THE CHEMICAL PUBLISHING COMPANY
1901

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 1.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. G. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Transition Temperature of Sodic Sulphate, a New Fixed Point in Thermometry. BY THEODORE WILLIAM RICHARDS. *Am. J. Sci.*, **156**, 201–208.—The author has accurately determined the melting-point of hydrated sodium sulphate, and finds it to be 32.48° according to the mean mercury thermometer. He strongly recommends the use of this salt for the standardization of thermometers, and describes the precautions to be observed. The chemically pure commercial salt is recrystallized twice, or better, until its melting-point is constant; it is then pulverized and partially melted in a wide test-tube over a flame, so as to form a pasty mass; a little powdered anhydrous sodium sulphate is added, the tube is inserted in a wider glass tube serving as an air-jacket, the whole is placed in a water-bath 0.5°–3.0° above the melting-point, and the semi-liquid mass, in which the thermometer is placed, is gently stirred.

The Use of the Transition Temperatures of Complex Systems as Fixed Points in Thermometry. BY THEODORE WILLIAM RICHARDS AND JESSE BRIGGS CHURCHILL. *Proc. Am. Acad.*, **34**, 277–280.—In reply to a note by Meyerhoffer and Saunders, the authors claim priority with respect to the matter stated in the title, and emphasize the advantages of using, for the purpose mentioned, the melting-point of a single hydrated salt over that of mixtures of salts. They give the approximate melting-points of nine salts, melting between 19.7° and 78°, which have been found suitable for the standardization of thermometers.

On the Dissociation of Phosphorus Pentabromide in Solutions in Organic Solvents. BY J. H. KASTLE AND W. A.

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BEATTY. *Am. Chem. J.*, **21**, 392–398.—Carbon disulphide and carbon tetrachloride solutions of phosphorus pentabromide of 0.025–0.001 molar concentration are found to have the same color as solutions in the same solvents containing a nearly equal number of bromine molecules, thus indicating that the dissociation is nearly complete. The addition of phosphorus tribromide to a carbon disulphide solution of the pentabromide causes it to become lighter in color.

On an Apparatus for Measuring Very High Pressures. BY A. DE FOREST PALMER, JR. *Am. J. Sci.*, **156**, 451–454.—The method consists in determining the change in electrical resistance produced by subjecting a mercury thread contained within a glass capillary tube to the pressure to be measured. With the help of the coefficient of change of resistance with the pressure previously determined by the author (*Am. J. Sci.*, **154**, 1), the pressure is readily calculated. It is stated that the error does not exceed 0.1 per cent., up to pressures of 2000 atmospheres.

The Compressibility of Colloids, with Applications to the Jelly Theory of the Ether. BY C. BARUS. *Am. J. Sci.*, **156**, 285–298.—It is found that the compressibility of *liquid* colloidal solutions (those of gelatine and albumen in water and of India rubber in ether) is not essentially different from that of the solvents, notwithstanding the great differences in viscosity; but that the same solutions, when coagulated or solidified, have a very much less compressibility, which, however, could not be measured by the method used owing to the occurrence of the following remarkable phenomenon: the mercury meniscus, at which the pressure was transmitted to the jelly in a capillary tube, assumed with increasing pressure a conoidal form, and threw off little globules of mercury which were projected with a jerky motion, even for a distance of 20 cm., through the jelly. The author attributes the phenomenon to the temporary breaking down of the thread of solid jelly in the middle of the tube, where it is least supported, and suggests that the inertia of matter and the phenomenon of the electric spark may be due to a similar behavior of the hypothetical ether.

On Some Experiments with Endothermic Gases. BY W. G. MIXTER. *Am. J. Sci.*, **157**, 323–327.—Acetylene is invariably caused to explode by large sparks or a red-hot platinum wire when the pressure is as high as three atmospheres, while at lower pressure these agents often fail to cause explosion. Small sparks, moreover, do not cause it even at much higher pressures. On the other hand, cyanogen does not explode when heavily sparked at five atmospheres, nor does nitrous or nitric oxide do so at twenty atmospheres. A simple experiment is also described

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illustrating the spontaneous decomposition of acetylene, and the accompanying evolution of heat: a slow current of the gas is caused to issue from a small tube into a larger one surrounding it, the latter being heated to dull redness by a burner at the place where the small tube ends. The jet is then seen to be filled with a cloud of glowing lampblack.

Some Boiling-point Curves. By C. L. Speyers. *Am. J. Sci.*, **159**, 341–344.—Under the assumption that the vapor-pressure equation $\frac{p-p'}{p} = \frac{n}{n+N}$ holds true for both components of a liquid mixture at all concentrations, the author has calculated the boiling-points of mixtures of carbon tetrachloride and benzene, carbon tetrachloride and chloroform, and chloroform and benzene, and compared the results with existing experimental data. The agreement is found to be close for the first two mixtures, but poor for the last one, perhaps owing to experimental errors. Hereto the reviewer would remark that, since two components whose vapor-pressures in the presence of each other are expressed by the above equation, cannot form a constant-boiling mixture, and since constant-boiling mixtures are extremely common where the boiling-points of the pure components do not differ greatly from each other (see *this Rev.*), the equation cannot at best, have more than a very limited applicability.

Lecture Experiments Illustrating the Electrolytic Dissociation Theory and the Laws of the Velocity and Equilibrium of Chemical Change. By A. A. Noyes and A. A. Blanchard. *J. Am. Chem. Soc.*, **22**, 726–752.—Seventeen experiments on the subjects stated in the title are described. Full details are given both for the preliminary preparation and the execution of the experiments, and the principles illustrated are explicitly stated.

On the Periodic System and the Properties of Inorganic Compounds. By James Locke. *Am. Chem. J.*, **20**, 581–592.—The article is principally devoted to the discussion of the important fact that the relations of the periodic system are only apparent when each element is considered in a particular one of its various states of oxidation. The author believes that the discovery of general principles can only be arrived at by a comparison of the physical properties and chemical reactions of compounds of the various elements in the *same* state of oxidation, and promises soon to publish the results of such an investigation.

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ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Molecular Dissociation of Nitroso Compounds. BY EDWARD KREMERS. *Pharm. Archives*, 1, 102–107.—The author discusses the change in color from white to blue of nitroso compounds, and comes to the conclusion that true nitroso compounds are bimolecular and that they become monomolecular when heated in solution. This dissociation is accompanied by a change in color. Exception is taken to the theory put forward by Baeyer in connection with these compounds.

Note on the Crystallography of a Reduction-product of Δ^4-Terpen-3-one. BY WILLIAM H. HOBBS. *Pharm. Archives*, 2, 21–23.

Some of the Unpublished Results of the Investigations of the Tannins by the Late Professor Henry Trimble. BY JOSIAH C. PEACOCK. *Am. Jour. Pharm.*, 72, 334–343.—The results of a large number of analyses of tannins from different sources are given. The hide-powder method was used exclusively in the work.

Note on Testing Formaldehyde. BY LYMAN F. KEBLER. *Am. J. Pharm.*, 70, 432–433.—In making a quantitative determination of formaldehyde by means of ammonia, it was found necessary to let the solutions remain in contact with one another for six hours in order to effect complete reaction. At the end of fifteen minutes, reaction had taken place to the extent of about one-half the total amount.

On the Preparation of Nucleic Acids. BY P. A. LEVENE. *J. Am. Chem. Soc.*, 22, 329–331.—Nucleic acid was prepared from the extract obtained by treating flesh tissues with sodium hydroxide. The solution was nearly neutralized with acetic acid, and picric acid was added to precipitate the proteid material. The acid was obtained by precipitating it from the filtered solution by means of alcohol.

On Urea-imido Esters, Thio-urea-imido Esters, Acylthio-urea-imido Esters, and Urea-amidines. BY HENRY L. WHEELER AND W. MURRAY SANDERS. *J. Am. Chem. Soc.*, 22, 365–379.—It is shown that representatives of new classes of compounds, isomeric or metameric with the acylpseudourea ethers, acylpseudothiourea ethers, and diacylpseudothiourea ethers can be prepared by combining isocyanates, mustard oils, and acylsulphocyanates with imido esters. The preparation and properties of a number of new substances belonging to these classes are described.

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The Direct Synthesis of Ketodihydroquinazolines from Ortho-amino Acids. By MARSTON TAYLOR BOGERT AND AUGUST HENRY GOTTHELF. *J. Am. Chem. Soc.*, **22**, 522–536.—The authors discuss fully the probable course of the reaction between anthranilic acid and acetonitrile by which 2-methyl-4-ketodihydroquinazoline is formed, and describe the hydrochloride, chlorplatinate, nitrate, chromate, and methyl ether of the quinazoline derivative.

On the Hydrocarbons in Heavy Texas Petroleum. By CHARLES F. MABERY AND D. M. BUCK. *J. Am. Chem. Soc.*, **22**, 553–556.—From analyses and molecular weight determinations of the fractions obtained by distilling a heavy Texas petroleum under diminished pressure the conclusion is drawn that the oil contains hydrocarbons from $C_{14}H_{26}$ to $C_{19}H_{36}$ of the series C_nH_{2n-2}, and higher hydrocarbons $C_{21}H_{38}$ to $C_{25}H_{46}$ of the series C_nH_{2n-4}.

The Action of Sodium Alcoholate upon Anisylidene Acetophenonedibromide. By F. J. POND AND ARTHUR S. SHOFFSTALL. *J. Am. Chem. Soc.*, **22**, 658–685.—In a former paper (*this Rev.*, **5**, 129) it was stated that sodium methylate reacts with the dibromides of certain unsaturated ketones of the general formula $R.CH:CH.CO.C_6H_5$, yielding 1,3-diketones of the formula $R.CO.CH_2.CO.C_6H_5$. The authors now show that the reaction-products have the formula $R.C(OH):CH.CO.C_6H_5$, for they form copper and iron salts, and exhibit the general reactions of compounds which contain the grouping $—C(OH)=CH—$. When a solution of anisylidene acetophenone dibromide in alcohol was boiled, hydrogen bromide was eliminated and an addition-product of monobromanisylidene acetophenone and alcohol was formed. By the action of hydroxylamine hydrochloride upon an alcoholic solution of α-oxyanisylidene, α,γ-methoxyphenylphenylisoxazole was produced. An isomeric isoxazole derivative was formed by the action of potassium hydroxide upon a mixture of anisylidene acetophenone dibromide and hydroxylamine hydrochloride. Bromine converts α-oxyanisylideneacetophenone into the compound $CH_3O.C_6H_4.CO.CHBr.CO.C_6H_5$. The reaction by which the enolic ketone is formed from anisylidene acetophenone dibromide was shown to take place in the manner represented by the following equations: $2RCHBr.CHBr.CO.R + 2NaOCH_3 = RCHBr.CH(OCH_3)CO.R + RCBr:CH.CO.R + CH_3OH + 2NaBr$; $RCBr:CH.CO.R + NaOCH_3 = RC(OCH_3):CH.CO.R + NaBr$; $RC(OCH_3):CH.CO.R + HOH = RC(OH):CH.CO.R + CH_3OH$. The intermediate products in the reaction were isolated and studied.

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On the Preparation of Triphenylchlormethane. By M. Gomberg. *J. Am. Chem. Soc.*, **22**, 752–757.—It is shown that when carbon tetrachloride and benzene react in the presence of aluminum chloride, the product formed is triphenylchlormethane, and not triphenylmethane, the substance which heretofore has been considered the result of this reaction. When care was taken to prevent the decomposition of the reaction-product by water a yield of 87 per cent. of the theoretical quantity was obtained.

An Instance of Trivalent Carbon: Triphenylmethyl. By M. Gomberg. *J. Am. Chem. Soc.*, **22**, 757–771.—When a solution of triphenylchlormethane in benzene or carbon disulphide is treated with mercury, silver, or zinc, the halogen is removed and, in the presence of air; a precipitate is formed which was shown by analyses and molecular weight determinations to have the composition represented by the formula $(C_6H_5)_3C—O—O—(C_6H_5)_3$. If air is excluded, zinc removes the chlorine quantitatively from the halogen compounds dissolved in benzene in five to six days and no precipitate is formed. The solution so produced absorbs oxygen rapidly from the air, and the peroxide is precipitated. It absorbs chlorine, bromine, and iodine at 0° readily. When iodine was used triphenyliodomethane was formed. This compound was isolated and studied. The author considers that the highly unsaturated substance formed by the reaction is the radical triphenylmethyl, $(C_6H_5)_3C—$, as it is evidently not hexaphenylethane, $(C_6H_5)_3C—C(C_6H_5)_3$, the substance which might be expected as the result of the action of a metal on triphenylchlormethane, $(C_6H_5)_3C.Cl$. The structure of the oxygen compound found by the action of oxygen on the unsaturated substance was shown to be $(C_6H_5)_3C—O—O—C(C_6H_5)$ by preparing it from triphenylchlormethane and sodium peroxide. The peroxide is converted by concentrated sulphuric acid into triphenylcarbinol and gives a hexanitro derivative when treated with nitric acid.

Some Double Salts Containing Selenium. By James F. Norris. *Am. Chem. J.*, **20**, 490.—The double chlorides and bromides of selenium and dimethyl- and trimethylamine were prepared and studied. It was found that in some of the bromides selenium oxybromide was present. No salt containing selenium chloride could be isolated; selenium oxychloride and selenium dioxide, however, united with the hydrochlorides of the amines to form well crystallized compounds. Double salts containing the perbromides of the amines are also described.

The Purification of Phloroglucinol. By G. S. Fraps. *Am. Chem. J.*, **24**, 270–271.—Commercial phloroglucinol, which contains diresorcinol, is readily purified so that it can be used in the de-

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termination of pentosans in vegetable materials by proceeding as follows: 11 grams of phloroglucinol are added to 300 cc. of hot dilute hydrochloric acid (sp. gr. 1.06). When only the insoluble impurities have not dissolved the solution is poured into 1200 cc. of cold hydrochloric acid of the same strength. The mixture is set aside for several days in order to allow the diresorcinol to crystallize out. The filtered solution is used in determining pentosans. Determinations of furfural by means of phloroglucinol purified in this way were in close agreement with those obtained when a chemically pure compound was used.

A New Synthesis of Secondary Amines. By ALFRED TINGLE. *Am. Chem. J.*, **24**, 276–281.—It has been previously shown by the author (*this Rev.* **6**, 138) that when methyl salicylate is boiled with aniline, the chief products are methylaniline and phenol. In the present paper, the action of aniline on ethyl and isoamyl-salicylate, and of ammonia on methylsalicylate is described. In all of these cases, a reaction similar to the one already reported was shown to take place, but only to a very slight degree. When ammonia was used, dimethylamine was formed. Isoamylsalicylate was prepared readily by boiling for three hours, a solution of salicylic acid in isoamyl alcohol containing a small amount of sulphuric acid.

The Electrolytic Oxidation of Toluene. By AARON MERZBACHER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **22**, 723–725.—A mixture of toluene, alcohol, and sulphuric acid was placed within a porous cup containing the anode, and electrolyzed. Small quantities of resin, ethyl benzoate, and benzaldehyde were produced.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Ferrous Iodide. By C. LORING JACKSON AND I. H. DERBY. *Am. Chem. J.*, **24**, 15–31; *Proc. Am. Acad.*, **35**, 213–227.—The many contradictory statements in regard to anhydrous ferrous iodide, have led the authors to prepare it by different methods, and to study carefully its properties. The most convenient method of preparing the substance is to pass iodine vapor over heated iron clippings. This is done in an apparatus consisting of three bicycle tubes so arranged that a current of nitrogen can sweep the iodine over the heated iron, and the ferrous iodide can collect in one of the tubes from which it can be easily removed. The anhydrous ferrous iodide forms crystalline plates of a deep red color with a slight brownish tint; in thick masses it is nearly black, and when melted it solidifies to a black-

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ish red crystalline mass. The crystals belong to the hexagonal system. It can be sublimed in a stream of nitrogen; part of it is deposited in the red crystalline plates, and part is carried further on in the tube, where it deposits as a reddish brown amorphous powder. Heated in the air it loses iodine and leaves a residue of ferric oxide. Exposed to the atmosphere the salt deliquesces quickly to a brown solution. Thin plates kept in a desiccator gradually lose their color, passing over into a white salt, which is ferrous iodide with two molecules of water. The anhydrous ferrous iodide dissolves in water with considerable evolution of heat, and deposits from hot concentrated solutions green crystals of $FeI_2.4H_2O$. Ferrous iodide is very susceptible to the action of oxidizing agents, but shows a striking resistance to reducing agents. It may be sublimed in a current of dry hydrogen, and is not changed when distilled with mercury. It is reduced when melted with molecular silver. Exposed to a current of ammonia gas, ferrous iodine combines with it to form the substance $FeI_2.6NH_3$, which is a white amorphous powder easily decomposed by water, with formation of ferrous hydrate, ammonium iodide, and ammonia. When hexammonia ferrous iodide is exposed to the vapor of bromine it absorbs it in large quantity, giving a product which is probably a mixture of ferric bromide, ammonium bromide, and ammonium bromiodobromide, NH_4BrI-Br. This last named substance was prepared by treating ammonium iodide with bromine vapor. This salt has a blood-red color in transmitted light, but is a brilliant green with a metallic luster by reflected light.

The Action of Carbon Dioxide on the Borates of Barium. By H. N. Morse and D. W. Horn. *Am. Chem. J.*, **24**, 105-137. The method of Morse and Burton for the determination of boric acid consists in passing carbon dioxide into an alcoholic solution of boric acid, and a measured volume of standard barium hydroxide solution, and in igniting and weighing the residue of barium carbonate and barium metaborate. Jones (*this Rev.*, **5**, 52), working in a similar manner with aqueous solutions, has criticized the method of Morse and Burton. He found it impossible to get constant results, and attributes these discrepancies to loss of boric acid. The authors point out that Jones made all of his experiments in aqueous solution, while theirs were made in alcoholic solution, which with the addition of the standard barium hydroxide solution, made the solution contain at least 78 per cent. alcohol. As the solubility of the metaborate is given as 1 part in 55,000, 125 cc. of the 78 per cent. liquid could not contain more than 2 milligrams of barium metaborate in solution. From this it would seem that carbon dioxide could hardly decompose the metaborate in solution as Jones alleges. In order to see whether

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boric acid was lost on evaporation of the alcoholic solution the alcohol was distilled off in a current of carbon dioxide. Only traces were found in the distillate even when the alcoholic concentration of the distillate amounted to 92 per cent. The test for boric acid in the distillate was made by the flame test which was found to show about 1 part of the acid in 14,200 parts of alcohol. Evaporation of water solutions likewise showed no loss of boric acid. Solutions of boric acid and an excess of barium hydroxide were treated with carbon dioxide, and then the water was distilled off in a current of hot air. Turmeric paper, which would detect 1 part of acid in 59,000 parts of water by a single dipping, and 1 part in 143,000 by dipping four or five times, failed to show the presence of boric acid in the distillate. In heating the mixture of barium carbonate and metaborate, it was found that at a full red heat the metaborate attacks the carbonate with expulsion of carbon dioxide. The temperature at which a mixture of the metaborate and carbonate of barium is stable, and which is still sufficiently high to insure the dehydration of the former, appears to be just under a red heat. If a mixture of metaborate and carbonate has been heated so high that some of the latter has been decomposed with formation presumably of a more basic borate, the lost weight is restored by exposing the material to the air, and drying in the desiccator.

The Composition of Nitrogen Iodide. By F. D. Chattaway: *Am. Chem. J.*, **24**, 138–158.—The reaction which takes place between sodium sulphite and nitrogen iodide was found to be a convenient means of studying the composition of nitrogen iodide prepared in various ways. The products of the reaction are sodium sulphate, ammonium iodide, and hydriodic acid. The free hydriodic acid was determined by means of standard alkali, the total amount of iodine by means of standardized silver nitrate, and the ammonia by distillation with potassium hydroxide. The ratio between nitrogen and iodine was determined in samples of nitrogen iodide prepared in the following ways: by adding a solution of iodine in potassium iodide to a solution of ammonia; by the action of a strong solution of ammonia upon solid iodine; by the action of an alcoholic solution of iodine upon ammonia; by adding ammonia to a solution of potassium hypoiodite, containing an excess of potash; and by the action of iodine monochloride upon ammonia. All the results show that the relation by weight between the nitrogen and iodine in the various specimens of nitrogen iodide analyzed, does not vary either with the mode of preparation or the state of aggregation of the compound, and that this relation is 2:3 when expressed in terms of the atomic weight of the two elements. When nitrogen iodide is exposed to sunlight, it breaks up quan-

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titatively into nitrogen and hydriodic acid, which proves that the molecule of the compound contains only nitrogen, hydrogen, and iodine atoms, and that each atom of iodine is associated with one atom of hydrogen. The simplest formula which expresses the composition is $N_2H_3I_3$. Attempts were made to produce other compounds of nitrogen and iodine, but without success. The various analyses of previous workers differ so widely, because their substances were usually washed with water or some other substance which causes decomposition.

The Action of Light on Nitrogen Iodide. By F. D. Chattaway and K. J. P. Orton. *Am. Chem., J.*, **24**, 159–167.—When nitrogen iodide suspended in a solution of ammonia is exposed to light, nitrogen is evolved and the solid disappears, ammonium iodide and ammonium iodate being formed in the liquid. These substances are formed by two reactions which go on simultaneously. Under the influence of light, nitrogen iodide breaks down quantitatively into nitrogen and hydriodic acid. Some of the nitrogen iodide, however, is hydrolyzed; ammonium hypoiodite is formed, and is then transformed into ammonium iodide and ammonium iodate:

$$N_2H_3I_3 + 3H_2O = 2NH_3 + 3HIO$$
$$3HIO + 3NH_3 = 3NH_4IO = NH_4IO_3 + 2NH_4I.$$

The amount of hydrolysis varies with the temperature and the illumination, from 2–4 per cent. being hydrolyzed on a bright day, and 25 per cent. on a dull day. The iodine existing as hypoiodite may be determined by means of arsenious acid; the iodine existing as iodate by acidifying with sulphuric acid and titrating the liberated iodine with sodium sulphite. The decomposition of nitrogen iodide by light in the presence of water is similar to that with ammonia, but secondary reactions take place between the hydriodic acid and undecomposed nitrogen iodide, whereby iodine is set free. The red end of the spectrum decomposes nitrogen iodide most readily, and the action becomes less as the wave-length of the light used diminishes.

The Action of Alkaline Hydroxides, of Water, and of Hydrogen Peroxide Upon Nitrogen Iodide. By F. D. Chattaway and K. J. P. Orton. *Am. Chem. J.*, **24**, 318–330.—The action of water and of alkalies upon nitrogen iodide is chiefly a hydrolytic one, by which are produced ammonia and an alkaline hypoiodite which is unstable and rapidly changes into iodide and iodate:

$$N_2H_3I_3 + 3KOH = 2NH_3 + 3KOI = 2NH_3 + 2KI + KIO_3.$$

At the same time a portion of the nitrogen iodide breaks down into nitrogen and potassium iodide in this way:

$$N_2H_3I_3 + 3KOH = N_2 + 3KI + 3H_2O.$$

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The extent to which each reaction takes place depends upon the conditions under which the decomposition is effected. Solutions of ammonia and of the alkaline earth hydroxides act similarly. Water causes analogous decompositions, but in this case some of the hypoiodous acid formed in the hydrolysis reacts with the hydriodic acid liberating iodine while any excess is transformed into iodine and iodic acid:

$$N_2H_3I_3 + 3H_2O = 2NH_3 + 3HOI$$
$$N_2H_3I_3 = N_2 + 3HI$$
$$HOI + HI = I_2 + H_2O$$
$$15HOI = 10HI + 5HIO_3 = 6I_2 + 3HIO_3 + 6H_2O.$$

Hydrogen peroxide dissolved in a solution of potassium hydroxide rapidly decomposes nitrogen iodide, ammonia, potassium iodide, and a trace of potassium iodate being produced. Oxygen and a little nitrogen are evolved.

The Action of Acids Upon Nitrogen Iodide. By F. D. Chattaway and H. P. Stevens. *Am. Chem. J.*, **24**, 331–341.—Dilute acids when added to nitrogen iodide, suspended in water, first induce hydrolysis of the compound, and hypoiodous acid is liberated, together with ammonia which combines with the acid. If acids be employed upon which hypoiodous acid has no effect, a rapid change into hydriodic and iodic acids occurs, the former being immediately oxidized by the latter, setting free iodine. With hydrochloric, hydrocyanic, and hydriodic acids, the hypoiodous acid reacts forming respectively iodine monochloride, cyanogen iodide, and iodine. Most acids, if at all concentrated, act so violently as to produce explosions.

The Formation and Constitution of Nitrogen Iodide. By F. D. Chattaway and K. J. P. Orton. *Am. Chem. J.*, **24**, 342–355.—The authors have studied quantitatively the actions of iodine and iodine monochloride on ammonia, the oxidation of sodium arsenite being used as a means of estimating hypoiodite, the formation of which always accompanies the formation of nitrogen iodide. In the case of free iodine exactly half, and in the case of iodine monochloride the whole of the iodine appears as nitrogen iodide and hypoiodite. The addition of ammonia to a solution of an alkaline hypoiodite is followed directly by the separation of nitrogen iodide. When an alkaline solution of potassium hypoiodite of known strength is used, and the hypoiodite estimated in the filtrate from the precipitated nitrogen iodide, the iodine as hypoiodite in the filtrate is found to be less than the iodine as hypoiodite originally present, by an amount which equals the iodine as nitrogen iodide. The latter is, therefore, formed at the expense of the hypoiodite, and the following

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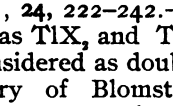
equations represent the action of iodine and iodine monochloride on solutions of ammonia :

$$I_2 + 2NH_4OH = NH_4I + NH_4OI$$
$$ICl + 2NH_4OH + NH_4Cl + NH_4OI$$
$$3NH_4OI = N_2H_3I_3 + 2H_2O + NH_4OH$$

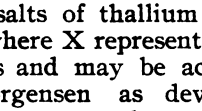
There is little direct evidence from which to deduce a constitutional formula. The formula, $NH_3.NI_3$, seems most probable. Nitrogen iodide, which has been allowed to stand under water, becomes much more liable to explode, and analyses of partly decomposed material point to a disintegration of the molecule and a liberation of the very unstable NI_3 in the residue.

On the Effect of Oxidizing Agents on the Reduction of Mercuric Chloride by Oxalic Acid. By J. H. Kastle and W. A. Beatty. *Am. Chem. J.*, **24**, 182–188.—Potassium permanganate greatly accelerates the reduction of mercuric chloride by oxalic acid in the sunlight. Two tubes each containing 5 cc. of a 5 per cent. mercuric chloride solution, and 10 cc. of a 4 per cent. ammonium oxalate solution were placed side by side in direct sunlight. To one was added 1 drop of 0.01 normal potassium permanganate solution. After ten minutes the mercurous chloride was filtered off and determined in each. In the one to which the permanganate had been added 28.2 per cent. of the mercuric chloride had been reduced ; in the other only 3.48 per cent. About 1 drop of a 1/160,000 normal permanganate solution is the smallest quantity capable of accelerating the reduction of mercuric chloride by ammonium oxalate. The reaction is retarded by mineral acids. Other oxidizing agents produce an accelerating effect. Thallic chloride behaves in a similar manner to mercuric chloride and is reduced to thallous chloride. The accelerating effect of oxidizing agents, the author supposes to be an alternating oxidation and reduction process.

On Some Isomeric Halogen Compounds of Thallium, and the Constitution of Double Salts. By Allerton S. Cushman. *Am. Chem. J.*, **24**, 222–242.—The salts of thallium of the empirical formulas TlX_2 and Tl_2X_3 (where X represents a halogen atom) are considered as double salts and may be accounted for by the theory of Blomstrand-Jörgensen as developed and extended by Remsen, or by the more recent theory of Werner. According to the older theory they can be represented by the formulas



and



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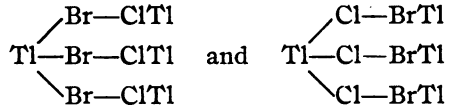
According to Werner, on the other hand, we may consider the latter salt to have a dominant thallium atom at the center of an octahedron, and the former salt to have this atom at the center of a tetrahedron. On this hypothesis the two compounds may be represented by these formulas $(Tl'''X_6)_3Tl$ and $(Tl'''X_4)Tl$. According to either of these theories it seemed possible to prepare isomeric double salts in which bromine atoms could be substituted for chlorine atoms, and *vice versa*. The author has prepared isomeric salts to which may be assigned the two formulas:



The former which crystallizes in blood-red hexagonal crystals, is formed when thallous chloride suspended in a considerable quantity of hot water is treated with a hot solution of thallic bromide. The latter crystallizes out in orange-colored hexagonal plates when thallous bromide suspended in hot water is treated with a dilute solution of thallic chloride. The orange-colored isomer is very stable and can be crystallized unchanged from water; the other isomer is easily decomposed, and can be recrystallized only from its mother-liquor. An orange-colored salt of the formulae $TlCl.Br_2.3TlCl$ was prepared by treating moist thallous chloride with bromine. Silver nitrate precipitates from neutral solutions of the sesquichloride of thallium, a salt having the composition $12AgCl,Tl_2O_3.3H_2O$. In the presence of 10 per cent. of nitric acid, however, pure silver chloride can be precipitated. The question of the constitution of these double salts is still unsettled. The facts that these compounds are dissociated into thallous and thallic salts, that silver nitrate produces complete precipitation in the cold, and that platinic chloride forms with these precipitates of thallium chlorplatinate, the thallic portion remaining in solution, are arguments against the Werner theory. The conductivity experiments, on the other hand, are in its favor.

The Action of Caustic Hydroxides on Aluminium. By E. T. Allen and H. F. Rogers. *Am. Chem. J.*, **24**, 304–318—Aluminates of the alkali and alkaline earth-metals were produced by allowing the hydroxide to act upon metallic aluminium. They may be considered as derivatives of the hydroxides of aluminium. The aluminates, $Ca_3(AlO_3)_2$, $Ba_3(AlO_3)_2$, $Sr_3(AlO_3)_2$, may be considered as derivatives of $Al(OH)_3$; $Ba_2Al_2O_5$ and $Ca_2Al_2O_5$ as derivatives of $H_4Al_2O_5$; and $Ba(AlO_2)_2$, $Sr(AlO_2)_2$, $K_2(AlO_2)_2$, $Na_2(AlO_2)_2$, and $LiH(AlO_2)_2$ as derivatives of $HAlO_2$. The most soluble bases form the least stable aluminates. They

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decompose with water, forming aluminium hydroxide which is crystalline or amorphous, according to the rapidity of the action. Lithium aluminate contains less base than the sodium and potassium salts, and is much more stable. The type of alkaline earth aluminate is dependent upon the relative proportions of metal, base and water.

Preparation of the Blue Oxide of Molybdenum and of Metallic Molybdenum. By Allen Rogers and F. H. Mitchell. *J. Am. Chem. Soc.*, **22**, 350–351.—By adding stannous chloride to an acid solution of ammonium molybdate, a blue precipitate was obtained, which the authors suppose to be the oxide, Mo_3O_8, although no analysis is given to support this view, and none of its properties were studied. Metallic molybdenum was obtained in the electric furnace from the blue oxide, but nothing is said of its purity.

Cause of the Loss of Weight of Commercial Platinum when Heated Under Some Conditions. By Robert W. Hall. *J. Am. Chem. Soc.*, **22**, 494–501.—The conditions under which platinum loses weight were examined. The loss of weight is greatest in an oxidizing atmosphere. The variable weight of platinum is supposed to be due to the formation of a volatile oxide, stable at high and low temperatures.

Notes on Lead and Cadmium Ferrocyanides. By Edmund H. Miller and Henry Fisher. *J. Am. Chem. Soc.*, **22**, 537–543.—The precipitate produced by bringing together solutions of potassium ferrocyanide and lead acetate corresponds to the composition $Pb_2Fe(CN)_6$, when either solution is in excess. In the presence of acids, the composition of the precipitate varies. The composition of cadmium ferrocyanide has not been determined.

On the Universal Distribution of Titanium. By Charles Baskerville. *J. Am. Chem. Soc.*, **21**, 1099–1101.—The ash obtained by incinerating fresh beef, beef bone, human flesh, and human bone has been examined for titanium, and found to contain the following amounts of TiO_2: beef bone, 0.0195 per cent.; beef flesh, 0.013 per cent.; human flesh, 0.0325 per cent.; human bone, a trace.

The Persulphates of Rubidium, Caesium, and Thallium. By Hugh Marshall. *J. Am. Chem. Soc.*, **22**, 48.—The persulphates of rubidium and caesium were prepared from the ammonium salt by double decomposition, and were found to be isomorphous with ammonium persulphate. Thallous persulphate has been prepared, but not in pure condition.

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Atmospheric Ozone. By R. A. HATCHER AND H. V. ARNY. *Am. J. Pharm.*, **72**, 423–429.—A preliminary report on the amount of ozone in the air at Covington, La.

Lithium Bicarbonate. By LYMAN F. KEBLER. *J. Am. Pharm.*, **72**, 580–581.—Because several manufacturers have supplied an article by the above name, the author was led to examine some samples, and found them to be crystallized lithium carbonate.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Equipment of Metallurgical Laboratories. By H. M. HOWE. *Trans. Am. Inst. Min. Eng.*, **29**, 721–728.—The author emphasizes the fact, that the main use of a metallurgical laboratory is to teach the principles, especially the chemical principles, which form the foundation of metallurgical practice, and that as soon as more stress is laid on laboratory work than to accomplish this end, it fails of its purpose, wastes the time of the student, and gives him wrong ideas. He advocates also the importance of small physical tests which do not require cumbersome apparatus and much material, and make clear many principles otherwise only imperfectly understood.

The Snyder Ore Sampler. *Editor Eng. Min. J.*, **70**, 549.—The machine consists of a circular, shallow disk-shaped iron casting, mounted with the bottom to a horizontal revolving shaft having a fast and loose pulley. The casting has a sector-like slot. The ore to be sampled is discharged in a stream against the revolving disk; the sample passes through the slot into a bin back of the disk, while the rejected ore glides down in front into a second bin. The Gates Iron Works, Chicago, are the manufacturers.

The Temperatures at which Certain Ferrous and Calcic Silicates are Formed in Fusion, and the Effect upon These Temperatures of the Presence of Certain Metallic Oxides. By H. O. HOFMAN. *Trans. Am. Inst. Min. Eng.*, **29**, 682–721.—In smelting non-ferrous metals, the slags made consist mainly of silica, ferrous oxide, and lime, the ferrous oxide being occasionally replaced more or less by manganous oxide, the lime by magnesia, baryta and zinc oxide and the silica and lime by alumina. The paper is a record of laboratory experiments carried out to obtain definite information on the formation temperatures of these slags which vary with the acidity and the character of the bases. The raw materials (SiO_2, $FeC_2O_4 + 2H_2O$, $MnCO_3$, $CaCO_3$, $MgCO_3$, $BaCO_3$, ZnO, Al_2O_3) were mixed in vary-

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ing proportions, moistened with a 10 per cent. dextrine solution, molded to the same form as small-size Seger cones (three-sided pyramids, $\frac{3}{4}$ inch base, $\frac{2}{3}\frac{5}{2}$ inch high), dried and melted down on platinum foil in a Seger gas furnace, using Seger cones as pyrometers. While Seger cones are no true pyrometers, but rather pyroscopes, they form the most satisfactory means of studying the conditions under which a mechanical mixture is converted into a chemical compound. In the experiments, (1) the formation temperatures were determined for the subsilicates, $4RO.SiO_2$ and $3RO.SiO_2$; the singulo-silicate, $2RO.SiO_2$; the three-to-four silicate, $3RO.2SiO_2$; the sesquisilicate, $4RO.3SiO_2$; and the bisilicate $RO.SiO_2$. With each series the start was made with the pure ferrous silicate, and the iron gradually replaced by lime. (2) The formation temperatures were determined for a cross-series of slags, starting from the subsilicate, $4RO.SiO_2$, and extending to the trisilicate, $2RO.3SiO_2$, the percentage of ferrous oxide being kept twice that of calcium oxide, with the purpose of studying the effects of a steadily increasing percentage of silica. (3) A singulo-silicate, in which the percentages of silica, ferrous oxide and calcium oxide were most evenly divided (SiO_2, 3.21 ; FeO, 35.9 ; CaO, 32), was chosen, and the effects of replacing the constituents studied. The results may be summarized as follows: (1). The pure ferrous silicate of a slag always has a higher formation temperature than when part of the iron has been replaced by lime. After a certain replacement, however, the temperature rises again, more or less steadily, until a practical infusible mixture has been reached. Slags more acid than a singulo-silicate allow only a very much smaller substitution of lime with lowering of formation temperature, than when more basic. With the pure ferrous silicate, the formation temperature rises as the silicate degree falls.

(2) The cross series shows that the formation temperatures are partly constant from the silicate degree 0.50 to 1.25, that they then fall to a minimum with a silicate degree 2.50–2.75, and then rise quickly. (3) Manganous oxide raises the formation temperature approximately in proportion to the degree of replacement of ferrous oxide. Magnesia decidedly raises it when replacing lime ; zinc oxide sometimes raises, then again lowers it, the irregularity being due probably to the fact that the whole of the zinc oxide is not always converted into silicate ; baryta lowers the formation temperature decidedly and uniformly. A combination of magnesia and zinc oxide does not improve matters ; baryta added to magnesia or to zinc oxide lowers the temperatures and straightens out the curves, proving it to be a powerful flux. Alumina made to replace silica raises the formation temperature very quickly ; if it replaces lime, the temperature sinks somewhat and remains constant until three-quarters of the lime has

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been thus replaced, when it rises quickly. Replacing ferrous oxide or ferrous oxide and lime by alumina gives irregular curves.

Utilizing the Heat of Molten Slag. By H. Lang. *Eng. Min. J.*, **70**, 334.—This paper is a continuation of the discussion previously referred to (*this Rev.*, **6**, 117).

A Decade of Progress in Reducing Costs. By C. Kirchhoff. *Trans. Am. Inst. Min. Eng.*, **29**, 352–371.—The paper discusses the costs of producing pig iron, Bessemer ingots, rolling rods, coking, and lead smelting and refining, and shows what the causes were that have contributed to the reduction of cost.

The Smelting Corporation's Works at Ellesmere Port, England. By J. S. F. Vogel. *Eng. Min. J.*, **70**, 365–366.—At these works, designed by W. B. Devereux, zinc-lead sulphide ores are roasted, briquetted, and then smelted in water-jacket blast-furnaces with sodium sulphate and iron oxides as fluxes according to the Fry patents. The slag has the following percentage composition: S, 14; SiO_2, 15; ZnO, 30; Fe, 22; CaO, 7; Na, 7, and small quantities of Pb, Mn, and Cu, and is thoroughly fluid. It runs off continuously at both ends of the blast-furnace into overflow slag-pots, while the lead is drained off through an Arents siphon tap.

Notes on Lead Smelting and Gold and Silver Refining, Cost of Smelting and Refining at the Globe Works, Denver, Colo. By M. W. Iles. *Eng. Min. J.*, **70**, 185–186.—Sulphide ores are roasted in hand and mechanical reverberatory furnaces. At the Globe Works the cost of roasting in the hand reverberatory furnace was reduced from $3.975 per ton in 1887 to $2.620 in 1898. This saving in expense was due (1) to widening the hearths 2 ft. which allowed the addition of 200 lbs. to each ore charge and increased in twenty-four hours the output per furnace 1200 lbs., and (2) to a change in the method of working, the ore being withdrawn from near the fire-bridge in a sintered instead of in a fused state. Two Brown-O'Hara furnaces were put in operation but did not give the results expected from them. The total coast of roasting during the year 1898 was in the hand reverberatory furnace $2.75 (labor $1.50, coal $0.98, general expenses $0.77); in the Brown-O'Hara furnace $2.21 (labor $0.76, coal $0.62, general expenses $0.83). The author believes that the apparent gain of $0.54 with the mechanical furnace is more than offset by the expenses of repairs not accounted for in the above statement. The cost of smelting in the blast-furnace was reduced from $4.644 per ton of ore in 1887 to $2,260 in 1898. This was due to the increase of size of furnace, and of pressure of blast, and to the improve-

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ments in the handling of ores and products. The cost of desilverizing of base bullion by the Parkes process showed a range of $3 to $5 per ton; the charges for interest, expressage of precious metal, brokerage, treatment of by-products, etc., make the total cost about twice as great.

Notes on Lead Smelting and Gold and Silver Refining. The Fallis Manometer. By M. W. Iles. *Eng. Min. J.*, **69**, 765–766.—For a description of this gauge the reader is referred to the original article containing complete drawings. M. W. Brown (*op cit.*, **70**, 93) calls attention to the fact that the Fallis manometer is a modification of an instrument invented many years ago by Dr. Wollaston (*Trans. North of England Inst. Min. Eng.*, **3**, 68; also *Trans. Inst. Min. Eng.*, **3**, 452).

Refinery Products. By M. W. Iles *School Mines Quart.*, **20**, 397.—The author publishes a list of forty-eight analyses and assays of refinery products, mostly from the works of the Globe Smelting and Refining Company, Denver, Colorado.

Welding Copper.—The Leibe Process. By C. E. Wait. *Eng. Min. J.*, **69**, 705.—The article records the results of some mechanical tests of welds made by the Leibe process of copper to copper, and copper to machine steel, the details of the mode of operating being withheld for the present.

New Smelting Works at Grand Forks, B. C. By A. W. B. Hodges. *Can. Min. Rev.*, **19**, 114–115.—The paper gives in outline a description of the "Granby" Copper Smelting Plant recently erected at Grand Forks.

Results of Smelting at the Hall Mines, Limited. By R. D. Headly. *Eng. Min. J.*, **70**, 214.—In the year ending September 30, 1899, the cost of matting sulphide copper ore was reduced from $3.66 per ton in the previous year to $2.96. This was due to the use of a larger blast-furnace. The cost was divided up as follows: flux, $0.196; fuel, $1.445 and labor, etc., $1.320. The matte averaged Cu, 45 per cent., Ag, 290 oz., and Au, 0.77 oz. per ton. The losses and gains in smelting were Au, + 10 per cent.; Ag, — 8 per cent.; Cu, — 6 per cent. In one of the reverberatory furnaces used for concentrating matte, the bottom, of 9-inch brick, had worn down in some places to 2½ inches. After tearing it out, it was found to contain 25 tons of copper, 20,000 oz. of silver, and 400 oz. of gold.

Testing Losses in Flue Dust in Cupola Furnace.—By N. P. Wood. *Min. Sci. Press*, **80**, 734.—J. B. Seager of the Helvetia Copper Co., Helvetia, Arizona, placed a sheet iron hood with

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hopper over the stack of a copper blast-furnace in order to save flue dust. The hood reversing the direction of the gases before they are allowed to pass off into the open causes them to drop a large part of the dust which is collected in the hopper. The amount thus saved was 4.26 per cent. on the charge, and the value of copper in the dust to that in ore charge was as 2 : 3. A screen analysis gave the following results :

Size screen.		Per cent. caught.	Cu.	SiO_2.	Fe.	CaO.
On	20	0.5	none	...	...	...
"	40	16.3	3.8	37.0	11.4	21.5
"	60	31.8	3.9	35.2	13.2	22.7
"	80	13.1	4.2	38.2	15.0	20.0
"	100	5.7	4.5	40.7	14.4	19.0
Through	100	32.3	4.7	44.0	15.0	14.5

They show that the fine dust is richer in copper than the coarse parts. The furnace is run on oxide and sulphide copper ore with a small proportion of carbonate. With high-grade carbonate ore, the fine dust would form a larger proportion of the whole, and the loss in copper be correspondingly greater.

A Cheap Method of Converting Matte. By J. H. Rodda. *Eng. Min. J.*, **70**, 123.—The method contemplates the use of the ordinary upright Bessemer converter. When turned into the horizontal position, it serves as fore-hearth for the blast-furnace receiving through an inlet at the side the matte-slag mixture, and settles out the matte while the slag overflows through the nose. When the converter is filled with matte, the side inlet is closed, and it is turned up and the matte blown in the usual way.

The Copper Queen Mine, Arizona. By J. Douglas. *Trans. Am. Inst. Min. Eng.*, **29**, 511–546. Discussed by E. Keller. *Ibid.*, 1056–1058.—After a detailed description of the occurrence of the ore and a discussion of its genesis, the author takes up the metallurgical treatment. The smelting plant consists of four oval slightly conical water jacket blast-furnaces, 42 × 120 inches at the tuyeres; a furnace has two tilting wells, the slag from one overflowing into the other. The clean slag from the second well is caught in a 2-ton ladle which is moved by an electric crane and discharged into a 4-ton slag car drawn to the dump by a locomotive. The same crane transports the matte poured from whichever of the eight wells that is full, to one of the three converters and returns the converter slag to one of the wells nearest a furnace, thus giving shots of matte the necessary time for settling. The converters are of the horizontal barrel-type. They are 8 feet long, and 5 feet 6 inches in diameter. The blast-furnace puts through in twenty-four hours 160 tons of a charge made up of

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oxide ore carrying some sulphur, low-grade clay-ore, and raw and roasted sulphide ore, so as to give a matte with 45 per cent. copper. Every tenth charge consists of briquettes made from fine ore-screenings, flue dust, and coke dust. Coarse screenings from the converters are added as extras. Acid and basic ores are so mixed that no flux is required. The coke consumption is 12.5 per cent., the coke containing 20 per cent. ash. The analysis of the ore charge shows: Cu, 9.1; SiO_2, 17.1; CaO, trace; S, 16.44; Fe, 29.7; Al, 5.4; Zn, trace; Pb, trace; Mn, 0.58; H_2O, 9.2 per cent.; Ag, 0.9 oz. per ton; Au, trace;—that of the slag: Cu, 0.6; SiO_2, 33.8; CaO, 1.11; S, 1.1; Fe, 37.7; Al, 13.15; Mn, 1.95 per cent.; Ag, trace. The converters are lined at the Bisbee works with a quartz-clay mixture carrying a small amount of copper; at the Morenci works an ore with 54 per cent. SiO_2 and 20 per cent. Al_2O_3 is used. The paper gives full details of four blows that a new converter lining will stand. It took nine hours forty-three minutes to make 15,070 lbs. of copper in 4 charges from 55 per cent. matte. From each charge samples were taken, 32 all together, and analyzed. The analysis of the samples taken from the last blow are subjoined. The values are all percentages except those in parentheses which represent the ounces of silver and gold per ton.

	Matte No. 25.	Slag poured No. 26.	Slag skimmings No. 27.	White metal No. 28.	Copper No. 29.	Granul. slag rakings No. 30.	Hood No. 31.	Lining No. 32.
Silica.....	....	32.57	35.16	....	....	43.14	1.14	86.64
Copper	57.86	3.18	4.22	77.58	99.05	9.27	75.72	0.23
Iron.....	17.68	50.84	50.43	0.98	0.164	27.195	3.31	2.22
Nickel.....	0.22	0.19	1.34	0.13	0.024	0.912	0.26	....
Zinc.....	0.21	0.42	....	0.05	0.016	0.04	0.163	....
Lead	1.85	2.25	....	0.48	0.08	2.84	1.51	....
Antimony...	0.03	....	....	0.15	0.018	....	0.023	....
Arsenic	0.04	....	....	0.17	0.016	....	0.033	....
Selenium } Tellurium }	0.04	....	....	0.02	0.044	....	0.053	....
Sulphur	21.34	....	....	20.11	0.07	....	12.40	....
Silver.....	5.86	(0.16)	....	(7.86)	(12.78)	(0.52)	(7.50)	....
Gold.....	0.12	....	....	(0.18)	(0.27)	....	(0.10)	....
Insol. resid..	0.39	....	....	....	....	....	....	....
Aluminum ..	....	....	....	....	....	....	0.22	3.71

Keller, calculating the elimination of impurities in Bessemerizing from the author's analyses, gives the following percentages: S, 99.2 per cent.; Fe, 99.6 per cent.; Zn, 93.8 per cent.; Ni, 93.1 per cent.; Pb, 96.2 per cent.; Sb, 70.6 per cent.; As, 79.5 per cent.; Se and Te, 35 per cent. In analyzing some samples obtained from the author, and separating selenium and tellurium, he found the elimination of selenium to be greater than that of tellurium. In the analyses of the author, nickel and cobalt are

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given together as nickel; Keller separated nickel and cobalt and found that cobalt formed 25–50 per cent. of the sum of the two metals. As cobalt is completely slagged in Bessemerizing, the elimination of nickel as 93.1 per cent. calculated from the author's figures is very much too high.

Steam Metal. By E. S. Sperry. *Aluminum World*, **6**, 91–92. *The Foundry*, **16**, 106–108.—Steam metal is an alloy of copper, tin, zinc and lead used for valves, cocks, injectors, couplings, unions, etc. If correctly made, it is strong, but not brittle, not easily corroded, and permits being worked at a high speed. A good all-round alloy contains Cu, 85 per cent.; Sn, 7 per cent.; Zn, 5 per cent.; and Pb, 3 per cent. Copper alone, while resisting corrosion, would be too soft and tough; it is therefore hardened by the addition of tin; this, however, makes unsatisfactory sand castings and zinc has to be added. Finally, in order to permit the alloy to be cut at a high speed, lead is added, but only a small quantity, as an excess would reduce the resistance to corrosion. The small amounts (under 1 per cent.) of chemically combined iron found in steam metal have no harmful effect; they perhaps make the alloy slightly harder. Any mechanically combined iron, however, becomes hardened in casting, and ruins the tools when the alloy is being cut. This iron gets into the metal from chips, pieces of tools, etc., contaminating the scrap from which steam goods are invariably made.

Emerson's Method of Producing Electrolytic Copper-Wire Bars. By E. Emerson. *Eng. Min. J.*, **70**, 399.—In this process a spiral strip of copper is deposited by electrolysis on a cathode using unrefined copper as anode; this strip is removed and suspended in another electrolyzing vat as cathode, and the deposition continued until a bar of sufficient size has been produced.

The Hans A. Frasch Electrolytic Process for Extracting Metals as Applied to Copper-Nickel Matte. By J. Struthers, *Eng. Min. J.*, **70**, 272–273. Discussed by W. Thum. *Ibid.*, 334.—The process consists of electrolyzing in a divided cell sodium chloride with nickel-copper matte as anode. The chlorine set free at the anode is to dissolve the metal, while the sodium is to form caustic soda as a valuable by-product. From the solution of metal chlorides, the metals are to be precipitated by electrolytic or by chemical methods. Thum's objections relate to the difficulty of making electric connection with anode particles that have become covered with sulphur, and of depositing copper and nickel from the chloride solution.

Notes on the Disintegration of an Alloy of Nickel and Aluminum. By E. S. Sperry. *Trans. Am. Inst. Min. Eng.*,

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29, 280. DISCUSSED BY A. E. HUNT AND S. PETERS. *Ibid.*, 1029–1030.—The author found that an alloy of equal parts of nickel and aluminium in about one month showed cracks on the surface, these slowly penetrated deeper, new cracks began to appear, the alloy split into many large pieces, and after three months had become entirely disintegrated, forming a coarse powder. The newly made alloy was very fluid, had a gray color like that of wrought iron and the fracture did not have any crystalline appearance. An alloy of 90 per cent. aluminum and 10 per cent. nickel remained sound. Hunt's observations agree with those of the author; he found that the same phenomena occurred with 50 per cent. of alloys of aluminum with iron, or manganese, or chromium, or tin. Peters observed in the early seventies in making ferromanganese with 80–85 per cent. manganese in a crucible, that after a lapse of some time the alloy crumbled to a fine powder, an odor of hydrocarbon being given off.

The Bryan Mill as a Crusher and Amalgamator Compared with the Stamp-Battery. BY E. A. H. TAYS. *Trans. Am. Inst. Min. Eng.*, 29, 776–782. DISCUSSED BY A. H. WYNNE. *Ibid.*, 1054–1056.—This paper gives the results obtained in amalgamating the same kind of gold ore in a 4-foot Bryan mill and a 5-stamp battery. A 4-foot Bryan mill costs about the same as a 5-stamp battery, but crushes about twice the amount of ore. The extraction of gold is about the same with both apparatus, but the battery saves 65 per cent. of the values inside the mortar, while only 33 per cent. is collected inside the Bryan mill. The Bryan mill requires less attention than the battery and the wear of iron is smaller. By reason of the higher cost of the castings used by the Bryan mill, the cost of wear is nearly three times greater than with the battery. In the discussion, Wynne states that in order to do satisfactory work with a roller mill, it is necessary to work with fluid and not with a soft-hard amalgam as is the case in battery amalgamation. He believes that if the author had used enough quicksilver, the saving in silver would have been nearer 80 per cent. than 33 per cent. The experience of others with this mill seems to prove that it is necessary to run with a hard amalgam, as was apparently done by Tays, because a very liquid amalgam would not remain in the mill.

The Patio Process in Guanajuato, Mexico. BY R. FERNANDEZ. *Trans. Am. Inst. Min. Eng.*, 29, 116–121.—The ores best suited for the patio process are those containing the silver in the form of argentite, then follow pyrargyrite, polybasite, stephanite, proustite, etc. Chlorides, bromides, and iodides of silver are considered to be refractory; blende, galena, bournonite, and pyritic

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ores are not suited at all. High-grade ores do not give as satisfactory results as those containing 40–50 oz. silver per ton. The ores at this celebrated mine are crushed in a roller-mill to pea-size, then ground in an arrastra to pass an 80-mesh screen, and amalgamated in the patio. The amalgam is separated from the sands in a settler, retorted, melted, and assayed. The wet pulp to be treated in one operation amounts to 100–250 tons. It is spread in the patio to the thickness of 12 inches. It should contain enough water to dissolve the salt and blue vitriol (40–60 kilos per ton) which are added, and thick enough to hold finely divided mercury (8 parts to one part silver) in suspension. The amalgamation lasts three to six weeks according to the time of the year. The progress of the operation is ascertained by panning some of the pulp, collecting the amalgam, volatilizing the quicksilver, and weighing the residual impure silver. Occasionally assays are made of the tailings. The treatment is considered to be at an end when the ratio of silver and mercury in the amalgam is the same as at the beginning of the amalgamation, allowing for loss of mercury 1.116 parts for 1 part silver, of which 1 part is chemical and 0.116 mechanical. The reactions that take place in the patio have been much discussed. Starting with cupric chloride formed by the action of sodium chloride upon cupric sulphate, they may be expressed according to R. Fernandez as follows :

$$2CuCl_2 + 2Ag_2S = Cu_2Cl_2 + 2Ag_2Cl + S_2$$
$$2Ag_2Cl + 2Hg = Hg_2Cl_2 + Ag_2$$

and

$$Cu_2Cl_2 + 2Ag_2S = 2CuS + 2Ag_2Cl$$
$$2Ag_2Cl + 2Hg = Hg_2Cl_2 + Ag_2.$$

A detailed statement of cost of treatment is given by the author: the total cost is $13.45 per ton; the loss in silver is 6.25 per cent.; the consumption of blue vitriol 4 kilos, and of salt 55.5 kilos per ton.

The Evolution of the 300-Stamp Mill on Douglas Island, Alaska. By H. Watson. *Min. Sci. Press*, **80**, 668.—This is a brief description of the celebrated gold mill which crushes per day 1300 tons of ore, assaying $3.00 gold per ton and containing 2 per cent. concentrates which are saved on belt machines. The tailings run usually from 10–15 cents per ton.

Cheap Mining and Milling at Spanish Mine. By H. F. Brown. *Min. Sci. Press*, **80**, 318.—The paper gives a brief description of the occurrence of gold and manner of working in this well-known mine where the ore yielding a trifle over 91 cents per ton, gives a profit of 32.6 cents, the cost of 58.5 cents being divided into mining, 34.6 cents, and milling, including general expenses, 23.9 cents.

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Gold Mining and Milling in Georgia. By H. V. Croll. *Min. Sci. Press*, **80**, 121–122.—This is a brief review of the past and present methods of working with special reference to the Dahlonega district, Lumpkin County.

Note on Plate-Amalgamation. By A. J. Clark. *Trans. Am. Inst. Min. Eng.*, **29**, 459–462. Discussed by Collins and Furman. *Ibid.*, 1039–1042. Referring to a paper by Bayliss on "The Accumulation of Amalgam on Copper Plates" (*op. cit.*, **26**, 33), in which it was stated that at the Drumlummon mill, Marysville, Mont., the silver of the ore showed a tendency to escape amalgamation, the amalgam nearest the battery being richest in gold, and that farthest from it richest in silver, the author records one set of tests he made in 1897 with samples of amalgam taken from the Golden Star mill of the Homestake Mining Co., Lead City, S. Dak., the results of which were similar to those of Bayliss; and a second set made in 1899 from the entire product of the plates of four batteries which wholly contradicted those from the first set of tests. He believes that an amalgamated copper plate has a weaker amalgamating power for silver than one that has been silverplated.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 2.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Some Observations on Practice of Cyanide Process at Mercur, Utah. BY W. MAGENAU. *Min. Sci. Press*, **80**, 433–464, 492.—The ores of the Mercur district are well suited for the cyanide process; they run from $3.00 to $12.00 in gold, and carry some silver; some large ore bodies contain from $1.00 to $2.50 gold, but with less than $2.50 gold per ton they can, at present, not be worked at a profit. The ores are of four kinds: (1) "Oxidized Ore," forming two-thirds of the ore milled, consists of ferruginous shale, siliceous limestone and decomposed porphyry. It frequently contains cinnabar. (2) "Base Ore," constituting one-fourth of the milling ore, resembles the oxidized ore as far as the rock is concerned, but carries realgar, orpiment, and stibnite, and sometimes native antimony, further arsenopyrite. (3) "Talcy Ore," of minor importance, is a compact clay (decomposed porphyry) which has to be calcined before it can be leached. (4) "Black Ore," dull black from carbonaceous matter, carrying good values, but not worked at present. The paper discusses only the treatment of oxidized ore, the manner of working the other ores having been described by H. L. J. Warren (*this Rev.*, **6**, 49). A peculiarity of the work is the coarse-crushing previous to leaching, 1- and 2-mesh sieves being common, the De Lamar mill only having found it necessary to use a 4-mesh screen. The explanation given for the coarse-crushing is that the gold occurs chiefly along minute lines of fracture into which the solutions penetrate readily. The machinery consists of gyratory crushers, rolls, and screens. The crushed ore, mixed with burnt lime, if necessary, is discharged into leaching tanks of 16–250 tons capacity. The common size holds 30–50 tons of ore, is circular and has sheet-iron sides and 3-inch red wood bottoms; the De Lamar

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mill has 250-ton vats. The filter in common use is a single thickness of burlap laid on strips, nailed to the bottom, and protected by a second row of strips (at right angles to the first) from the shovels, when the tailings are being discharged; the filtrate is somewhat turbid, but less so than would be expected from the percentage of slimes in the charge. Only one strength of solution is used, being admitted sometimes from above, sometimes from below. The total time required for the leaching of a charge is sixty to one hundred and twenty hours. It is made up of a number of separate percolations, the solvent being every time drained off. In a given time, a large number of short percolations gives better results than a few of longer duration. The first percolation lasts about eight hours, the others less time. It has been noticed that the gold is rendered soluble after a few hours' contact with the cyanide, and that the bulk of the time is required to wash out the gold solution from the ore. The amount of wash-water used is generally equal to the amount of moisture remaining in the drained ore. The extraction from ore with $3.00 to $5.00 gold per ton ranges from 70–80 per cent., the ordinary variations being 72–76 per cent.; with ores assaying over $5.00 gold per ton the extraction is normally above 80 per cent.; with base ores after roasting, 90 per cent. and over. The gold is precipitated from the solutions (carrying when rich, $3.00 to $4.00, when poor $0.60 to $1.00 gold per ton) with zinc shavings or zinc dust. The shavings are made of No. 30 sheet zinc, 50 sheets at 12 lbs. forming a "cake." Six sheets at a time are wound around a wooden mandrel (5 inches in diameter), tied with cord and then cut in a screw-cutting machine; the tool ("self-tempering steel") is held by the automatic carriage and cuts the shavings from one end. A mandrel geared to 50 revolutions per minute and cutting to $\frac{1}{1000}$ inch makes 50 lbs. shavings in eight hours. The space taken up by the zinc in the precipitating box is 1 cubic foot for every $3\frac{1}{2}$ tons of ore in twenty-four hours. The precipitation with zinc-dust has already been described (*this Rev.*, 6, 49). The gold precipitate contains less than 6 per cent. gold. This is due to the settling out of the slimes from the turbid filtrates of the leaching tanks and to the presence of disintegrated particles of zinc. The precipitate is separated from the undecomposed shavings by screening with sieves ranging from 4- to 10-mesh; they are then dried, sampled, and shipped to a lead smelting plant. Refining at the works by treatment with sulphuric acid and nitric acid under a hood, provided with a suction fan to carry off poisonous gases, is carried on at one mill only. The following two analyses give an idea of how greatly the percentage composition of samples of slimes varies.

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	Au.	Ag.	Al_2O_3 and Fe_2O_3.	Ca.	Mg.	Zn as metal.	ZnO.	Pb.	As.	Hg.	SiO_2.	Other elements.
I	4.56	0.05	3.00	3.20	0.07	38.28	35.86	1.20	0.25	0.10	6.10	7.58
II	5.26	trace	0.92	2.78	0.48	55.38	16.66	0.53	0.71	0.31	2.12	14.85

The subjoined analysis shows the composition of the solids of a working solution: Zn, 0.062; Ca, 0.005; Mg, 0.0009; Fe, trace; SO_3, 0.102; K_4FeCy_6, 0.0002; KCyS, 0.0015; Cy, 0.092; K, 0.1000; total, 0.27 per cent.

There are in the district two mills (Northern Light and Chloride Point) treating silver ores with potassium cyanide. The ores contain 2–20 ozs. silver per ton; the mode of operating i similar to that of the gold mills. The solutions contain abou 100 times as much metal as those in the gold mills; the extraction is 60–70 per cent.

The Cyanide Process at Mercur. By D. C. Jackling. *Min. Sci. Press*, **80**, 582–609.—This paper treats of the process carried out at the Golden Gate Mill which has a capacity of about 800 tons calcined and roasted, and 200 tons raw ore. The ores are classed as "oxidized ores," a calcareous and silicious variety, "talcy ores," a decomposed porphyry, and "base ores" calcareous and talcose rock with large quantities of base-metal sulphides. The ore is crushed to pass a 2-inch ring; it then passes through a mechanical drying furnace which discharges it into Berthelet screens, to separate out the fines. The coarse part goes through roughing rolls ($\frac{1}{2}$ inch apart), and after the fines produced have been taken out by sieves, to finishing rolls. The finished oxidized ore will pass a 3-mesh screen (No. 16 wire) and is ready to be leached; the talcose ore passing a 4-mesh screen (No. 15 wire) is calcined in a Jackling furnace (see *this Rev.* **6**, 47). The base ore, finer than an 8-mesh screen (No. 16 wire), containing 2–5 per cent. sulphur and 1–$2\frac{1}{2}$ per cent. arsenic, is roasted in the same furnace, the sulphur being reduced to 0.75 per cent. and the arsenic to 0.10 per cent. The high percentage of sulphur is due to the formation of calcium sulphate. The main difficulty to be encountered is that, in the peroxidation of the iron of the pyrite and arsenopyrite by raising the temperature, the ore is liable to sinter which interferes with the subsequent leaching. In calcining, the talcy ore is fed so as to lie 6 inches deep on the hearth, the rabbles traveling somewhat more quickly than in roasting base ores (40 ft. per min.); the ore remains six hours in the furnace and 140 tons are put through in twenty-four hours. In roasting base ores, the ore lies 4 inches deep, remains eight hours in the furnace, and 65 tons are worked in twenty-four hours. Careful investigation has shown that there is no volatilization — loss of gold in roasting and a very small loss by dusting. The oblong leaching tanks (size not given) must be large, as 1 tank has in the bottom eight discharge

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gates, 15 inches in diameter, through which the tailings are shoveled into trucks standing beneath. Gravel filters are used. They consist of a framework of wooden strips (1 x 4 inches, set on edge, 5 inches apart and held by two 1 x 4 inch blocks, nailed fast 18 inches apart) 4 inches deep, filled 2 inches with ¾-inch, 1 inch with ½-inch and 1 inch with coarse sand. The three layers are separated by two pieces of 12-ounce burlap and the top is covered with 16-ounce burlap and this is protected by iron strips against injury in shoveling out the tailings. The top 16-ounce burlap has to be renewed once a year, the underlying 12-ounce burlap once in two years; the top layer of sand has then also to be replaced, on account of its having become somewhat clogged by slimes. In leaching, the first solution (under a head of 14 feet), containing 0.4–0.5 per cent. potassium cyanide, is admitted from below; it reaches the surface in about eight hours when sufficient solution is run in from the top to cover the charge to a depth of 2 inches. It is allowed to stand sixteen hours, is then drawn off and at the same time fresh solution turned on; the leaching by percolation lasts about 48 hours. This solution is followed by a weaker solution, 0.30–0.35 per cent. potassium cyanide for 48–72 hours (the time required being determined by assays made on samples taken from the ore), and then washed and drained in twenty-four hours. The time required for leaching is five to six days, and the total time between charges is six to seven days. All solutions are run into storage tanks; with strong working solutions (0.45 per cent. potassium cyanide) the storage-tank solution will contain 0.33–0.35 per cent. potassium cyanide. The rate of leaching is ¾–1 inch per hour; with base ores, this rate drops to ¼–⅛ inch. The best ratio of solution and wash-water to ore is as 2:1. In leaching roasted ores having a gange of argillaceous and silicious limestones it happens that the ore comes to a set (cement) which retards the percolation of the solvent. The consumption of cyanide is 0.9 lb. per ton of ore, 0.45 lb. being consumed when the strong solution is being applied; the rest is mostly lost by imperfect washing. The low solution is made alkaline by the addition of caustic soda (1 lb. soda to 1 ton solution) before it is brought up to the standard with solid potassium cyanide. This effects a saving of 1 pound of cyanide for every pound of caustic added. The gold is precipitated by means of imported zinc dust containing about 90 per cent. metallic zinc. A tank with a capacity of 30 tons of solution is half-filled, air at 10–15 lbs. pressure is forced in through a ½-inch pipe to act as a stirrer, 5 lbs. of zinc dust are sifted into the tank while the tank is filling, and the sifting is finished when the tank is filled. The air hose is now removed, the suspended matter allowed to settle for half an hour and the supernatant liquor drawn off through the side, 8 inches above

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the bottom, and passed through a filter press to collect any suspended gold slimes. With a head of 18 feet no other pressure is required unless the filters (Canton cloth) are filled with slimes. The precipitated solutions assay about 20 cents gold per ton. In the monthly clean-up, the precipitating tanks are drained and the slimes are passed through the presses. The slimes are then dried in iron pans placed in cast-iron muffles and the filter-cloths burned; the whole is then pulverized to pass a $\frac{1}{4}$-inch screen. The pulverized mass containing $2\frac{1}{2}$-3 ounces gold per pound is treated with sulphuric acid to which some nitric acid has been added, care being taken to remove the fumes. The residue, after being washed in a filter press and dried, contains 60 per cent. gold and 40 per cent. slimes; it is pulverized, fluxed with soda, potash, and borax, and melted in a No. 300 plumbago crucible in a double oil-burning furnace large enough to hold two crucibles. The bullion, 950 fine, is cast into 1000-ounce bars. The cost of refining is 15 cents per ounce of gold.

Successful Precipitation from Solutions Weak in Cyanide. By M. W. Alderson. *Min. Sci. Press.*, **80**, 316–317.—The author gives further evidence of the value of his practice (*this Rev.*, **6**, 50) of adding some fresh potassium cyanide to the head-compartment of a zinc box in order to make the zinc active as a precipitant, and furnishes a new explanation of the manner in which this addition acts. In his first experiments he found that the solution, strengthened by the addition of fresh salt, dissolved the crusts that had formed with the ordinary weak working solution and concluded that this was its sole effect. Following, however, Christy's reasoning (*this Rev.*, **3**, 144) upon experiments on the precipitation of gold from cyanide solutions, he believes that the effect of the addition of potassium cyanide is to dissolve the film which is liable to form on the surface of the zinc and hinder the galvanic precipitation, either by preventing contact or by setting up a counter electromotive force. Gold is satisfactorily precipitated from dilute cyanide solutions as long as the zinc remains active. This addition of fresh salt becomes necessary at intervals when the activity of the zinc begins to decrease. The salt is not, as might be thought, disseminated quickly through the entire solution, but is taken up gradually, though it had all been dissolved. As far as his present experience goes, the author advises to add solid cyanide every six hours—with a new plant one pound cyanide per ton of solution; later, half a pound and even less will be found to be necessary.

Precipitation in Cyaniding. By M. W. Alderson. *Min. Sci. Press*, **81**, 124.—The author attacks the statement frequently made that from a cyanide solution at 90° F. better results are ob-

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tained in precipitating with zinc than at ordinary temperature. In his experience he obtained as good results at 32° F. as at 120° F. He also does not accept the statement that the precipitation of the gold is at present connected with any difficulty, and cites a number of examples with the necessary references to substantiate his own experience by that of others.

"Wet Crushing and Cyaniding the Silicious Ores of the Black Hills, South Dakota," and "Some Further Mill Practice in Cyaniding the Silicious Ores of the Black Hills, South Dakota." By J. M. Henton. *Min. Sci. Press*, **80**, 261; **81**, 284.—The Dakota Mining and Milling Co., of Central City, S. D., treats the silicious ore west of Deadwood by wet-stamping with a stock solution of potassium cyanide as battery water. The results have, on the whole, been very satisfactory. The gold in the ore is present in such a fine state of division as not to be readily amalgamated. It is crushed through a 6-mesh woven screen, a low discharge being used. Of the pulp, 18 per cent. remains on a 20-mesh screen, 12.6 per cent. on a 40-mesh, 7.4 per cent. on an 80-mesh, 7.4 per cent. on a 100-mesh, and 49.4 per cent. is finer than a 100-mesh screen. The pulp coming from the battery is run into a wooden tank (16 feet in diameter and 7 feet high) having an Alderson agitator (*this Rev.*, **6**, 50), and the overflow is collected in a sump to be pumped into the storage tank of the battery. When sufficient pulp has collected in the tank, the battery is stopped and the agitator started, enough potassium cyanide having been added to bring the solution to the most efficient strength. Agitation lasts about three hours, stock solution is run in and made to overflow so as to carry off the slimes which are settled in a tank large enough to hold what is formed in a few days' run. The sands are run into an ordinary leaching vat and are treated there by percolation in the usual way. The gold solution is precipitated by shavings in a zinc box, 13 x 2 x 2½ feet, a zinc compartment being 30 inches long, 18 inches deep, and 15 inches wide. Only four compartments were found to be necessary, the rate of flow being about one ton per hour. The zinc boxes are cleaned up once a week. It will benoted that there is no gold-solution tank between the settling vat and precipitation box to hold back any slimes that may pass along. This may make it necessary to clean up the boxes oftener than once a week. An improvement on the old arrangement is the insertion of a "V" box to settle out the sands which are then discharged into the agitating tank.

The paper concludes with some experiments on the assay on cyanide solutions. These were evaporated in the gold pan in various ways with and without litharge, and in a lead tray. The

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results show that all these methods give approximately concordant results. The following table will show the conditions of the solutions and the precipitation during the month of January, 1900. Columns I and II contain the values in dollars of the solution entering and leaving the zinc box; column III, the pounds of KCN per ton; and column IV the percentage alkalinity in terms of H_2SO_4:

I.	II.	III.	IV.
$3.30	$0.00	1.1	0.3
2.80	0.00	1.7	0.55
3.10	0.40	2.0	0.5
2.80	0.30	1.3	0.45
2.80	0.15	1.8	0.7
2.70	0.05	2.0	0.6
2.70	trace	1.9	0.45
3.00	0.15	2.0	0.5
3.20	0.35	2.4	0.85
2.40	0.20	2.4	0.75
2.60	0.05	2.3	0.65
4.10	0.15	2.4	0.5
3.20	1.70	2.9	1.00
3.80	0.15	2.1	0.4
3.90	0.10	2.0	0.7
4.80	0.50	2.2	0.55
4.20	0.40	1.5	0.4
4.00	0.50	2.5	0.5
3.50	0.15	2.2	0.4
4.60	0.30	1.4	0.25
4.00	0.20	2.1	0.3

The Cyanide Works of the Liberty Bell Gold Mining Co., Colorado. By F. L. Bosqui. *Eng. Min. J.*, 70, 337–338.—The successful treatment of the ore of this mine is connected with many difficulties, especially as the silver is present in a form that is not readily amalgamated. Until recently the method of working (see Winslow, *Trans. Am. Inst. Min. Eng.*, 29, 296) consisted in plate amalgamation, followed by concentration on Wilfley tables. As the extraction amounted to only 50 per cent. of the combined values of gold and silver, treatment with potassium cyanide was tried, and this proved so satisfactory that a 240-ton cyanide plant was erected. The only difficulty encountered was the slimy character of the tailings, which made filtering difficult. The leaching room, 190 by 44 feet, has a double tier of leaching vats, five to a tier, each 33 feet inside diameter and 8 feet deep, holding 275 tons tailings. The precipitating room, 135 by 30 feet, holds two storage tanks (20 feet in diameter and 15 feet deep), four zinc precipitation boxes, two vacuum cylinders connected with a 7 x 10 Stilwell-Bierce and Smith-Vaile vacuum pump, two Gould rotary pumps for raising solution, and a clean-up plant consisting of a 2 x 7 feet redwood acid tank, a double

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plunger Johnson pump, and a 12-compartment Johnson filter-press with two sump tanks, each 15½ feet in diameter and 6 feet deep. The tailings from the Wilfley tables are run from a common center in radiating launders to the upper or collecting vats (on grades ranging from 2.2 to 4 per cent.), being fed by revolving pipe-distributors. The slimes are carried off by means of overflow-gates, of which there are four to a vat. By this arrangement a charge is obtained of which about 45 per cent. will pass a 100-mesh screen and can be satisfactorily leached, while the slimy overflow, about 25 per cent. of the whole, is so fine that less than 1 per cent. will remain on a 150-mesh screen. From the upper or collecting tanks the pulp is shoveled through bottom-discharge doors into the leaching tanks below (5 men discharging a tank in ten hours at a cost of 6 cents per ton). From the lower tanks the tailings, after treatment, are removed by sluicing. They assay 0.07–0.10 oz. gold and 2–2.5 ozs. silver per ton. The cost of treatment for three months is shown in the following table. The item of chemicals includes cyanide, lime, sulphuric acid, and zinc:

	May.	June.	July.
Labor	$0.318	$0.235	$0.255
Chemicals	0.973	0.390	0.371
Assaying	0.044	0.030	0.043
Shipping bullion	0.009	0.001	0.001
Taxes, insurance, and depreciation	0.212	0.101	0.135
Miscellaneous	0.018	0.004	0.008
Totals	$1.574	$0.761	$0.813

When the plant is worked to its full capacity the cost will be reduced to $0.55 per ton.

The Treatment of Low Grade Silicious Ore of the Rossland Camp, by Cyanide of Potassium. By G. V. Hopkins. *Can. Min. Rev.*, 19, 131–134.—The process used at this mill is that of Pelatan-Clerici which aims to combine lixiviation with amalgamation assisted by electricity. While it has been a failure wherever else it has been tried, it is stated to have been successful here. From a solution worth $4.00 gold per ton, the values are said to have been reduced in six hours to $0.07, the current being of 70–80 amperes at 5–7 volts. The paper gives full drawings of the plant and interesting details as to the method of working.

Telluride Ores and the Treatment of Them. By T. A. Rickard. *Eng. Min. J.*, 70, 93–94.—Considerable difficulty has been encountered in treating the telluride unoxidized gold ores of the Great Boulder Main Reef, Kalgoorie, Western Australia. They have been overcome by Skewes and Marriner by grinding the

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roasted ores in pans, previous to leaching with potassium cyanide, and allowing the tailings to run over amalgamated copper plates to save the coarse gold. In roasting tellurides, the tellurous oxide formed combines readily with ferric oxide, forming tellurite of iron which is liable to coat the particles of gold and make them non-amalgamable. The extraction is 96 per cent. on ores and 93–98 per cent. on tailings, and the cost of treatment $4.75 a ton.

The Real Fuel Ratio. By S. C. Jewett. *Foundry*, **16**, 208–209.—The author calls attention to the wrong custom of judging the work of a cupola solely by the amount of fuel that is consumed. He shows, *e. g.*, how different the temperature of the metal must be when a few heavy castings are to be poured from large ladles from that when small castings are made from small ladles. In the former case the metal need not be so hot as in the latter and the cupola will require less fuel.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Relative Values of the Mitscherlich and Hydrofluoric Acid Methods for the Determination of Ferrous Iron. By W. F. Hillebrand and H. N. Stokes. *J. Am. Chem. Soc.*, **22**, 625–630.—In the presence of sulphides the Mitscherlich method yields high results as a consequence of the oxidation of these compounds at the expense of the sulphuric acid used for decomposition, or at the expense of ferric compounds present. The error from this source seems to be negligible under the conditions of the hydrofluoric acid procedure, unless the proportion of pyrite in the mineral is very large.

Estimation of Pyrrhotite in Pyrite Ores. By F. B. Carpenter. *J. Am. Chem. Soc.*, **22**, 634–637.—Determinations are made of total sulphur and of silicon by the usual methods. A portion of the ore is treated with concentrated hydrochloric acid, water, and alcohol, then dried at 100°, and weighed. This weight, less that of the silica, is assumed to represent FeS_2. After deducting the sulphur corresponding to this FeS_2 from the total sulphur, the pyrrhotite (Fe_7S_8) corresponding to the residual sulphur is calculated.

On the Determination of Phosphoric Acid as Phosphomolybdic Anhydride. By H. Sherman and Henry St. John Hyde. *J. Am. Chem. Soc.*, **22**, 652–658.—A neutral solution of ammo-

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nium molybdate is added, drop by drop, to the nitric acid solution of the phosphate (of definite acidity), the temperature being maintained at 50°. The precipitate is filtered on a Gooch crucible, which, after the washing of the precipitate, is placed in a nickel crucible and the latter is heated to dull redness for fifteen minutes. The residue is $P_2O_5.24MoO_3$. The procedure appears not to be influenced by the presence of the salts commonly occurring in the course of phosphate analyses, with the possible exception of ammonium chloride.

A New Volumetric Method for the Estimation of Copper. By S. W. PARR. *J. Am. Chem. Soc.*, **22**, 685–689.—The copper-bearing material is dissolved in nitric acid in slight excess, the copper is reduced by sulphurous acid and precipitated by potassium thiocyanate. The cuprous thiocyanate is filtered on an asbestos felt, which, with the precipitate, is treated with sodium hydroxide and standard potassium permanganate solution until the yellow of the solution gives place to a brown or green. Dilute sulphuric acid is then added in excess, and the titration completed to the usual end-point, with permanganate. The reaction is

$$10CuCNS + 14KMnO_4 + 21H_2SO_4 = 7K_2SO_4 + 14MnSO_4 + 10HCN + 10CuSO_4 + 16H_2O.$$

A Method of Determining Free Alkali in Soaps. By R. E. DIVINE. *J. Am. Chem. Soc.*, **22**, 693–695.—The soap is treated with an excess of stearic acid in alcoholic solution, and the excess is measured by standard alkali solution. The amount of the acid neutralized by the soap is taken as a measure of the total free alkali. Another portion is treated with alcohol, this solution mixed with one of barium chloride, and titrated with stearic acid, and the amount thus used is taken as a measure of the free caustic alkali. The carbonate is determined by difference.

Free Arsenious Oxide in Paris Green. By E. W. HILGARD. *J. Am. Chem. Soc.*, **22**, 690–693.—The importance of a microscopical examination is urged, and the author points out what, in his opinion, are the weak points in the procedure adopted, notably by Eastern experiment stations, for the detection of arsenious oxide in Paris green.

Note: The Analysis of Arsenical Insecticides. By J. K. HAYWOOD. *J. Am. Chem. Soc.*, **22**, 705–706.—The author finds that some copper oxide passes into solution when 1 gram of Paris green is treated with 500 cc. of water. He concludes that the Paris green is partially decomposed. Compare preceding abstract and *this Rev.*, **6**, 149.

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Determination of Carbon in Ferrochrome. By A. A. Blair. *J. Am. Chem. Soc.*, **22**, 719–723.—An apparatus is described for the decomposition of the ferrochrome by means of acid sulphate, and the treatment of the products of the reaction. Reference should be made to the drawings with the original article.

The Separation of Tungsten Trioxide from Molybdenum Trioxide. By Max J. Ruegenberg and Edgar F. Smith. *J. Am. Chem. Soc.*, **22**, 772–773.—The separation is made by means of sulphuric acid of a specific gravity of 1.378, in which the tungsten trioxide is insoluble. The presence of considerable quantities of iron do not affect the solubility of the tungsten oxide.

A Method for the Rapid Determination of Carbon in Steel. By Robert Job and Charles T. Davies. *J. Am. Chem. Soc.*, **22**, 791–797.—The authors have studied the methods for the determination of carbon with the idea of still further reducing the apparatus and procedure to the simplest form consistent with accuracy. Reference should be made to the cuts and details in the original paper.

Determination of Iron in Magnetite Ore by the Specific Gravity Test. By Joseph W. Richards. *J. Am. Chem. Soc.*, **22**, 797–798.—Magnetite ores which are mixtures of magnetite and quartz can be examined (using relatively large weights) by the aid of a gravity balance with a resulting maximum error of 0.1 and often only 0.02 or 0.03 in the gravity as determined, corresponding to variations of 1 to 3 per cent. in iron. A table is appended showing percentages of iron for gravities from 2.66 to 5.18.

Irregular Distribution of Sulphur in Pig Iron. By Randolph Bolling. *J. Am. Chem. Soc.*, **22**, 798–799.—In the opinion of the author, the sample pig should be drilled entirely through for the determination of sulphur, owing to varying distribution of that element throughout the casting.

Aluminum as an Electrode. By George J. Hough. *J. Am. Chem. Soc.*, **20**, 302–303.—The author finds that aluminum can be substituted for platinum as the cathode in copper determinations.

Silica and Insoluble Residue in Portland Cement. By P. W. Shimer. *J. Am. Chem. Soc.*, **21**, 289–291.—If the cement is decomposed by acids, and the residue, after dehydration, is ignited and weighed but not treated with hydrofluoric acid, the percentage results may be materially too high with cements which have not been properly compounded and burned. The difference between the percentages found by this procedure and those found

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after fusion of the cement, are, in general, an index of the care used in its manufacture.

Separation of Metallic Sulphides by Means of Hydrochloric Acid. By J. Bird Moyer. *J. Am. Chem. Soc.*, **21**, 642–645.—The following separations were accomplished by heating the sulphides in an atmosphere of hydrochloric acid: lead from arsenic, lead from antimony, lead from bismuth, cadmium from arsenic, silver from arsenic.

F. J. Moore, Reviewer.

Comparative Accuracy of Titrimetric and Gasometric Methods of Estimating Hydrogen Dioxide in Presence of Various Preservative Agents. By Carl E. Smith. *Am. J. Pharm.*, **70**, 225–234.—The author tests four methods for the determination of hydrogen peroxide: (1) direct titration of the solution with permanganate in acid solution; (2) application of the same reaction, measuring the liberated oxygen; (3) oxidation with sodium hypochlorite and measurement of the gas evolved; (4) oxidation with potassium chlorate in the presence of potassium iodide, and titration of the liberated iodine by means of thiosulphate solution. He finds the first method accurate, but not applicable in the presence of organic preservatives like glycerine. The last method is recommended in all such cases. The author does not favor either of the gasometric methods.

A New Volumetric Method for the Determination of Silver. By Launcelot W. Andrews. *Am. Chem. J.*, **24**, 256–266.—In Pisano's method for the determination of silver, a solution of starch iodide is run into the silver solution in the presence of suspended calcium carbonate. The author finds that strict proportionality does not exist between the amount of silver present and the iodine used. Addition of the starch iodide to an acid solution makes this discrepancy greater and does not yield a satisfactory end-point. It is believed that the following reaction takes place in the solution: $AgNO_3 + I_2 = AgI + INO_3$. The existence of the compound INO_3 is assumed to explain the behavior of the solution during titration, as it shows marked oxidizing properties. It is found that if a little of a ferrous salt or nitrous acid is added to the solution, much better results are obtained. The ferrous solution does not act upon the starch iodide provided an equivalent amount of ferric iron is also present. With these changes the method yields a satisfactory end-point, and is especially recommended for the determination of small amounts of silver, though a correction for dilution is necessary. The author suggests the use of a starch iodide solution for all uses to which a standard iodine solution is usually put, claiming that it is more

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permanent and that it does away with the necessity of frequently preparing a starch indicator. Full directions for the preparation of such a solution are given.

A New Method for the Determination of Aluminium. By E. T. Allen and V. H. Gottschalk. *Am. Chem. J.*, **24**, 292–304.—Few precipitates offer so many inconveniences in manipulation as aluminum hydroxide, especially when it is free from iron. The gelatinous precipitate settles slowly, clogs the filter, is difficult to wash, and is apt to run through the filter. These considerations led the authors to look for an insoluble compound of aluminum which should be crystalline. Such a compound was found in the basic carbonate. This is easy to filter and entirely insoluble. Unfortunately it holds back a certain amount of fixed alkali, which cannot be removed by washing. This renders its direct weighing impracticable. It was found, however, that this compound, on being boiled with water, reverts to the hydrate, and that the hydroxide thus formed was much easier to filter and wash than that prepared in the ordinary way. Upon these facts the authors base a method which may be outlined as follows: The solution containing aluminum is nearly neutralized with ammonia. A stick of potash whose silica content is known is then dissolved in water, and the solution cautiously run in from a burette until the precipitate first formed redissolves, a large excess being undesirable. This solution is then precipitated with a current of carbon dioxide, and the precipitate is filtered and washed. The filter is pierced and the precipitate washed back into the beaker in which the original precipitation was made and boiled two or three minutes with water containing ammonium salts, then again filtered, washed, ignited, and weighed in the usual manner. The authors claim a considerable gain in time over the ordinary method. The presence of iron does not affect the results. The fact that the method is inapplicable in the presence of the alkaline earth metals must seriously limit its usefulness.

On the Separation of Nickel and Cobalt by Hydrochloric Acid. By Franke Stuart Havens. *Am. J. Sci.*, **156**, 396–398. Pinerùa (*Gazz. chim. ital.*, **27**, 56) has recently published a method for separating nickel and cobalt, based upon the fact that cobalt chloride is soluble in ether which has been saturated with hydrochloric acid, while nickel chloride is insoluble. The author has repeated this work and finds that under the conditions stated by Pinerùa the nickel chloride is not entirely insoluble. By reducing the amount of water present to a minimum he is able to avoid this difficulty, but even then the process is available for separation only when very small amounts of cobalt are

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concerned. Larger quantities are invariably held back by the insoluble nickel chloride.

The Application of Iodine in the Analysis of Alkalies and Acids. By CLAUDE F. WALKER AND DAVID H. M. GILLESPIE. *Am. J. Sci.*, **156**, 455–462.—Phelps (*this Rev.*, **2**, 67) has shown that when barium hydroxide is boiled with an excess of iodine, the following reaction takes place:

$$6Ba(OH)_2 + 12I = BaIO_3 + 5BaI_2 + 6H_2O.$$

After the excess of iodine has been boiled off, the solution is acidified and the liberated iodine titrated with the thiosulphate solution in the usual way. The authors find that the same method can be successfully applied to potassium hydroxide, but that it is not applicable in the case of sodium carbonate. They modify the method of Phelps in a few manipulatory details.

The Action of Carbon Dioxide upon Soluble Borates. By LOUIS CLEVELAND JONES. *Am. J. Sci.*, **155**, 442–446.—Morse and Burton (*Am. Chem. J.*, **10**, 154) have suggested the following method for the determination of boric acid: To the alcoholic solution containing the boric acid a known excess of barium hydroxide is added over and above what is necessary to form barium metaborate. Carbon dioxide is then passed in to change the excess of barium hydroxide to carbonate, and the whole evaporated to dryness and ignited to constant weight. From this weight the amount of boric acid can be obtained by an indirect calculation. The success of this method depends on the correctness of the assumption that only the barium hydroxide is affected by the carbonic acid, and not the metaborate. The author finds that this is by no means the case. On the contrary, he finds that it is possible, by means of carbonic acid, to decompose practically all of the barium metaborate and volatilize all the boric acid with alcohol. He finds that it is impossible to verify the results of Morse and Burton by any variation of procedure.

A Technical Scheme for the Rapid Determination of Small Amounts of Copper in Chilled Slags. By CHARLES F. SHELBY. *Eng. Min. J.*, **69**, 708.—The slag is dissolved in aqua regia, evaporated and heated to dehydrate silica. After re-solution and removal of the silica, sodium thiosulphate is added to reduce the iron. Boiling with a little metallic zinc now precipitates the copper as sulphide. The latter is filtered off and determined by the cyanide or iodide method.

The Rapid Determination of Copper and Nickel in Sulphide Ores and Matte. By TITUS ULKE. *Eng. Min. J.*, **70**, 303.—The crushed ore is treated successively with hydrochloric and

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nitric acids, and the nitrates formed finally dissolved in water and the solution filtered. A little more nitric acid is added and the copper removed by electrolysis, a current of 0.2 to 0.3 amp. being used. The solution is now oxidized by means of hydrogen peroxide, and the iron removed by three precipitations with a large excess of ammonia. The combined filtrates are evaporated to about 200 cc., more ammonia added, and the solution electrolyzed hot by a current of 2 to 3 amp. Iron anodes must be used, as the solution attacks platinum and the deposited nickel then becomes contaminated with it.

The Titration of Mercury by Sodium Thiosulphate. By JOHN T. NORTON, JR. *Am. J. Sci.*, **160**, 48–56.—Scherer (Lehrbuch der Chemie) has suggested that mercurous nitrate, mercuric nitrate, and mercuric chloride can all be titrated directly by means of sodium thiosulphate, Hg_2S, $2Hg_2S,HgNO_3$, and $2Hg_2S,HgCl$ being the products formed in each case. These methods have been incorporated by Sutton in his "Volumetric Analysis." According to his statements, satisfactory results should be expected with each of these methods except the last. The author finds all three very unsatisfactory, but succeeds in getting good results by maintaining rigidly certain fixed conditions of temperature and dilution. The most radical of his modification is the use of an excess of the thiosulphate, the excess being determined by titration with iodine.

The Statement of Rock Analyses. By HENRY S. WASHINGTON. *Am. J. Sci.*, **160**, 59–63.—The importance to petrographers of a uniform order in the statement of rock analyses is emphasized. It is suggested that the following order be observed: SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, Na_2O, K_2O, H_2O by ignition, H_2O at 110°, CO_2, TiO_2, ZrO_2, P_2O_5, SO_3, Cl, F, S (FeS_2), Cr_2O_3, NiO, CoO, MnO, BaO, SrO, Li_2O.

A Rapid Method of Determining Lime in Blast Furnace Slags. By TITUS ULKE. *Eng. Min. J.*, **69**, 164.—The slag is dissolved in nitric acid. After removal of barium by means of sulphuric acid, ammonia is cautiously added until the solution becomes dark red, but not enough of it is added to precipitate any of the iron. A liberal excess of solid ammonium oxalate is now added and the solution boiled. The precipitate of calcium oxalate is rapidly filtered and washed, and finally titrated by permanganate.

The Colorimetric Assays of Copper. By GEORGE C. HEATH. *Eng. Min. J.*, **70**, 364.—This paper consists of a polemical discussion of the subject.

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The Analysis of Uranium and Vanadium Ores. By OLIVER P. FRITCHLE. *Eng. Min. J.*, **70**, 548.—This method is especially applicable to the analysis of the mineral carnotite, a hydrous potassium uranium vanadate. The ore is treated with nitric acid, and the solution is boiled with sodium carbonate and an excess of 20 per cent. sodium hydroxide. This precipitates the iron and uranium, the vanadium being held in solution by excess of alkali. The precipitate is dissolved in nitric acid and the solution heated with ammonia and ammonium carbonate. This precipitates the iron, which is filtered off and eventually titrated with permanganate. The uranium solution is treated with sulphuric acid and evaporated till white fumes appear. After dilution the uranium is reduced by the addition of scraps of metallic aluminum, and the solution titrated with permanganate. For vanadium it is best to dissolve another sample in nitric acid, to add sulphuric acid, expel the nitric acid, reduce with aluminum, and titrate uranium, iron, and vanadium together by permanganate. The permanganate required for the iron and uranium is then deducted.

Note on the Ferrocyanide Titration of Zinc. By EDWARD H. MILLER AND E. J. HALL. *School Mines Quart.*, **21**, 267.—The authors study the effect of the presence of several salts upon the results of this method, and sum up their results as follows: "(1) The amount to be subtracted as shown by a blank test is often greater than the excess required in an actual titration. (2) Salts such as calcium chloride, and sodium citrate, and acids, notably hydrochloric acid, retard the end reaction by their solvent action on uranium ferrocyanide. (3) Ammonium chloride, not exceeding ten grams, does not interfere with the accuracy of the method, but has some (unknown) effect on the zinc ferrocyanide. (4) The presence of considerable quantities of aluminum sulphate, such as would be present if copper were removed by aluminum foil, renders the results unreliable. (5) Six cubic centimeters of concentrated hydrochloric acid is sufficient to prevent any interference of lead. (6) Antimony gives high results, while small amounts of bismuth have no influence."

The Analysis of Slags and Cinders. Part I: Lead and Copper Slags. By C. H. JOÜET. *School Mines Quart.*, **22**, 64–74.—This article contains a detailed scheme for the determination of those constituents of slags whose estimation is required in practical furnace work. Any adequate condensation is impracticable.

The Estimation of Copper in Ores by the Modified Cyanide Process. By O. H. PACKER. *Min. Sci. Press*, **81**, 312.—This article makes no claim to originality. It gives detailed directions adapted to the use of those who are not "expert chemists."

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PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

The Assay of Fluid Extract of Belladonna. By W. A. PUCKNER. *Pharm. Rev.*, **16**, 303–308.—In adapting Keller's method for the assay of alkaloidal drugs to the assay of fluid extracts the extract is either dried upon sawdust or else it is shaken with a definite quantity of the solvent and an aliquot portion of the latter taken for the further assay. The first method is tedious, and in the second, serious error may be introduced in the removal of the aliquot portion. The author avoids the evaporation of the fluid extract and extracts the alkaloid from the entire quantity of fluid used by repeated extractions of the ammoniacal solution with small quantities of chloroform. From the chloroform it is extracted by successive portions of one per cent. hydrochloric acid, and from this solution it is again removed by extraction with chloroform and ammonia. The solution is evaporated to dryness and the alkaloidal content of the residue determined by titration with twentieth-normal acid.

The Assay of Belladonna Leaves. By W. A. PUCKNER. *Pharm. Rev.*, **16**, 180–183.—Ten grams of the powdered drug are shaken with 50 cc. of chloroform-ether mixture and 5 cc. of ten per cent. ammonia water. The solution is subjected to percolation and the alkaloids determined volumetrically by means of twentieth-normal acid as in the method in ordinary use.

The Quantitative Estimation of Carvone in Volatile Oils. By F. W. ALDEN AND S. NOLTE. *Pharm. Archives*, **2**, 81–91.—Since several chemists have reported adversely on the method proposed for the estimation of carvone as carvoxime, the previous work (*Pharm. Rev.*, **14**, 76) was repeated and the conditions more fully studied. The conditions were widely varied and the results were on the whole satisfactory.

On the Volumetric Estimation of Methyl Salicylate. By EDWARD KREMERS AND MARTHA M. JAMES. *Pharm. Rev.*, **16**, 130–133.—About 5 grams of methyl salicylate are saponified in sodium hydroxide, care being taken to use at least 7 molecules of sodium hydroxide to 1 of the ester. The solution is diluted to 500 cc. and 10 cc. are transferred to a flask and heated to about 60°. An excess of $\frac{1}{10}$-normal iodine is added, the flask shaken, the solution cooled, diluted to 500 cc., and filtered. In an aliquot part of the filtrate the excess of iodine is determined by titration with $\frac{1}{10}$-normal sodium thiosulphate.

The Detection of Salicylic Acid in Foods. By F. A. GENTH, JR. *J. Franklin Inst.*, **145**, 228–229.—A number of preserves

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have been tested for salicylic acid by "pulping" with phosphoric acid, straining, distilling, and testing portions of the distillate with ferric chloride. In a number of cases where the sample was known to be free from added preservative a color reaction was obtained similar to that given by salicylic acid. The color in dilute solutions was violet, in more concentrated solutions reddish. The nature of the distillate and of the process is being studied.

Diastasimetry. By David L. Davoll. *Pharm. Archives*, 1, 73–85.—The author discusses the question of the conversion of starch by diastase and gives the results of a study of diastasimetry based upon the iodine reaction, in which both the kind of starch and the strength of the iodine solution have been considered and the amount of reducing substances present at the "end-reaction" has been determined.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. Crosby, Reviewer.

Granites of Southern Rhode Island and Connecticut with Observations on Atlantic Coast Granites in General. By J. F. Kemp. *Bull. Geol. Soc. Am.*, 10, 361–382.—All the granites described are biotite granites, muscovite, though present, being very subordinate and hornblende failing entirely. The following types are recognized: Westerly gray, Westerly red, Stony Creek red, Stony Creek gray, and Lyme pink. The petrographic descriptions of these types and of the contact phenomena and basic inclusions as well as of the associated aplite and pegmatite, are followed by a discussion of the chemical composition based upon six analyses, four of which are new. The silica is quite uniform, varying from 68.40 to 73.05, but with only one below 70 per cent. The Rhode Island granites run somewhat higher in lime than the Connecticut granites. The magnesia is very low in nearly every case. The soda in relation to the potash is relatively high in some types and low in others, while one, the red granite of Stony Creek, proves to be one of the purest potash granites on record. The paper closes with a general review of the granites of the Atlantic sea board, which are believed to belong to several different geological periods and among which the biotite granites largely predominate.

Igneous Complex of Magnet Cove, Arkansas. By Henry S. Washington. *Bull. Geol. Soc. Am.*, 11, 389–416.—This paper is an able and timely review, in the light of the modern ideas of magmatic differentiation, of the limited and isolated area of plutonic rocks so carefully mapped and described by J. F. Williams

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ten years ago. The scope of the paper is clearly and tersely indicated in the author's summary, from which the reviewer quotes. The structure of the complex is briefly described, and from the evidence of its broadly elliptical outline, relations to surrounding shales, the presence of an overlying zone of metamorphosed rocks, the arrangement and serial petrographical and chemical characters of the main types, together with other minor points, it is shown that the igneous complex is probably a laccolith, and certainly a unit or integral mass of intruded magma. The component abyssal types are not due to successive injections as was suggested by Williams, but are the products of a differentiation in situ of the originally homogeneous mass of intruded magma ("laccolithic differentiation" of Brögger). The main rock types are briefly described, some new analyses being given; and they are shown to form a regularly graded series, ranging from foyaite, through leucite-porphyry, shonkinitic syenite, normal ijolite, and biotite ijolite to jacupirangite. This serial and common genetic character is shown both mineralogically and chemically. It is probable that the dikes of tinguaite and nepheline-porphyry are aschistic (undifferentiated injections of the still fluid differential zones into the surrounding rocks), while those of the monchiquitic rocks are diaschistic (products of a still further differentiation of these zones). The arrangement of the abyssal rocks is abnormal and differs radically from most other cases of differentiated masses, in that there is progressive increase in acidity toward the periphery, the analogous case at Umptek in Kola being especially mentioned. An explanation of this, based on a process of fractional crystallization or freezing of the magma, which is regarded as a solution, the solvent crystallizing first, is given, and the hypothesis is applied to other cases. It is suggested that all laccoliths and similar masses of magma may be referred to at least four different types, dependent on the chemical composition of the magma as a whole, the differences between which would be satisfactorily accounted for by the hypothesis. In the opinion of the reviewer, the explanation of this contrast between the normal centripetal acidity and the abnormal centrifugal acidity of plutonic masses might be strengthened and simplified by recognition of the important rôle as a solvent of water, which, so far as known, is universally present in magmas, and is the one important constituent which never freezes.

Contact Metamorphism of a Basic Igneous Rock. By Ulysses Sherman Grant. *Bull. Geol. Soc. Am.*, 11, 503–510.—The rock referred to is the Keweenawan gabbro, occupying a roughly crescentric area of about 1,000 square miles in the northeast corner of Minnesota, between Lake Superior and the Canadian boundary. The contact phenomena are described only for

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the northwestern border of the gabbro, which the author regards as probably intrusive, where it lies upon the Archaean, Keewatian and, especially, the quartzite, iron-bearing series, carbonaceous slate and graywacke slate of the Animikie. The metamorphism is very noticeable, and consists of a partial or complete recrystallization of the adjacent rocks. Complete recrystallization is the rule near the contact, and in places this extends 500 feet from the contact; while a partial recrystallization is at times noticeable for two or three times this distance from the present margin of the gabbro. The rather normal metamorphic characters of the slaty members of the Animikie are first briefly noticed, and then the specially interesting contact phenomena of the iron-bearing series are more fully described. The original rock is regarded as having been a glauconitic green sand, in which there was more or less iron carbonate. This rock has been widely altered by regional metamorphism to a quartz-magnetite-amphibole slate commonly known as actinolite schist, which has in turn been profoundly changed by the gabbro, the resulting rock being a coarse-grained aggregate of quartz, magnetite, olivine, or fayalite, hypersthene, augite, hornblende, etc. The derivation of all these minerals, including those like olivine, augite, and hypersthene, which are characteristic of basic, igneous rocks, and rarely found in metamorphosed sediments, from the actinolite schist, is shown to be possible; and the proofs that this contact zone really belongs to the Animikie and not to the gabbro are summarized. The contact phenomena of the Keewatin are said to vary greatly, with biotite as a prominent feature. In the Archaean, the acid rocks or granites have escaped sensible metamorphism, while the basic rocks or greenstones, including gabbros, diabases, and diorites, have been profoundly altered, and usually in a way to make them difficult to distinguish from the gabbro itself.

A Granite-Gneiss Area in Central Connecticut. By Lewis G. Westgate. *J. Geol.*, 7, 638–654.—This is purely a petrographic paper, describing an elliptical area of gneissoid granite on the Connecticut river east of Middletown. The phenomena and inclusions of the enclosing schists prove the granite to be intrusive, in spite of the marked and persistent foliation. It assumes frequently the character of an "augen"-gneiss. Basic segregations or schlieren of dark color and fine grain are a common feature, strengthening the proof of an igneous origin, as do the associated dikes of pegmatite and the contact zone of granulite. The component minerals, from which the chemical composition may be approximately deduced, are chiefly quartz, various feldspars and biotite, the feldspars including most abundantly orthoclase with an acid plagioclase and subordinate microcline. The accessories include titanite and a very little apatite and magnetite. In the granulite, garnet is the chief or only accessory.

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Suggestions Regarding the Classification of the Igneous Rocks. By WILLIAM H. HOBBS. *J. Geol.*, **8**, 1–31.—After noting the importance of adapting the classification to the needs of the field geologist as well as the petrologist, the bearing of recent petrographical studies on rock classification, the definition of a rock as an object rather than as an integral part of the earth's crust, the importance of texture as a basis of classification, the need of combining chemical and mineralogical classifications as a basis for rock classification and of substituting quantitative for qualitative analyses, that rock relationships should be indicated by the combination of names into a binomial, or, if necessary, a polynomial nomenclature, the author introduces graphical methods as essential to a comprehensive study of rock analyses. The system of diagrams proposed by Brögger for this purpose is preferred. In these are set off on radius vectors the amounts of the eight principal chemical constituents reckoned in molecular ratios, ferrous and ferric iron being entered upon the same radius vector, and silica, because so much in excess of the others, being evenly divided between the two horizontal radius vectors. A broken line joining the intercepts on the eight radius vectors forms a polygon, which may be long and narrow, or short and thick, convex above or below, or reentrant in any portion, left- or right-handed, etc., according to the chemical constitution of the rock. When viewed in this diagram the rock comes to have a handwriting by which it may be instantly recognized ; and when drawn to scale the diagram not only shows the chemical character of the rock but all the results of analysis may be read from it numerically. The main purpose of this paper is to adapt the Brögger diagram to represent, not merely an individual analysis, but a rock species or type covering a considerable range of differing analyses. In other words, composite diagrams are proposed, each representing the average of a group of analyses. Examples are given for the principal types of plutonic and volcanic rocks. The possibilities of the method are farther illustrated by grouping the diagrams in natural series, which show progressive changes in form ; and also by introducing a composite of each series. The numerous analyses upon which the diagrams are based are quoted in tabular form.

The Nomenclature of Feldspathic Granolites. By H. W. TURNER. *J. Geol.*, **8**, 105–111.—Accepting the principle that the classification of granular rocks, if not of lavas, should be based on mineral composition, the author notes that this is equivalent to a classification based on molecular composition, in so far as the minerals are composed each of one kind of molecules. But plagioclase is an exception, since it is composed of two kinds of molecules in ever varying proportions. The author proposes that the

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molecular classification be applied throughout ; and hence, in calculating the composition of the feldspathic rocks the plagioclase should be resolved into the constituent albite and anorthite molecules, and the name plagioclase should not be used. This is shown to be particularly necessary with the monzonites and diorites, which contain both orthoclase and plagioclase, since the plagioclase may vary from a basic labradorite to an acid oligoclase, thus giving rocks which could not properly be designated by the same name. It is suggested, therefore, that if we subdivide the feldspathic rocks on the basis of the ratio of the alkali-feldspar molecules (Or + Ab) to the lime-feldspar molecules (An) the true mineral and chemical relations of the rocks will be brought out and a better classification result. A graphic illustration is given in tables showing percentages of the alkalies and lime and the ratios of Or + Ab to An for the principal feldspathic types. The author further suggests the use of mineralogical terms in naming granolites of simple composition, as orthosite for a rock composed chiefly of orthoclase, albitite, for one composed chiefly of albite, etc. ; the names of other essential constituents to be used in substantive forms, as quartz-orthosite or granite, and of accessory constituents in adjective form, as quartziferous syenite, etc.

The Origin of Nitrates in Cavern Earths. By WILLIAM H. HESS. *J. Geol.*, **8**, 129–134.—The nitrates are not derived from the excrement of bats, as popularly supposed, but have their origin in the oxidation or nitrification of organic matter in the surface soil through the agency of bacteria, and the subsequent leaching of the nitrates so formed downward into caverns, where they slowly accumulate with other salts as the water escapes by evaporation. This explanation is in harmony with the fact that bats penetrate but short distances from the entrance to a cavern, while the distribution of the nitrates is entirely without reference to the entrance, the cavern earth of the Mammoth Cave having been worked for nitrates for a distance of over five miles from the only opening to the surface. Three analyses show that nitrates form but a small part of the soluble salts of the cavern earth, which include also sulphates and chlorides, and may aggregate as much as 13 per cent. The general conclusion as to the origin and source of the nitrates is sustained by a comparison of analyses of the soluble portions of (1) subsoil from the surface above the Mammoth Cave, (2) cavern earth from the subjacent part of the cave, (3) bat guano, and, (4) cavern earth immediately below the bat guano. A comparison of bulk analyses of bat guano and cavern earth follows ; and it is suggested that the calcium phosphate of the latter cannot be referred to the former, since the insolubility of this salt makes it a necessary residuary product of the solution of limestone. Analyses show that the water drip-

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ping from the roofs of caves is not markedly different from ordinary subdrainage waters. The nitrates and other soluble salts accumulate only in the earths of relatively dry caverns, or where the inflow of water does not exceed in amount the water removed by evaporation; and numerous analyses show that all dry caves contain nitrous earths. Nitrates found under overhanging cliffs are of a similar origin—evaporation of water which has percolated through the soil; and essentially the same explanation will fit the case where nitrates accumulate on the surface of a manure heap, through the joint action of capillary attraction and evaporation.

The Calcareous Concretions of Kettle Point, Lambton County, Ontario. By REGINALD A. DALY. *J. Geol.*, **8**, 135–150.—The concretions occur in a horizontally bedded, fissile, black, bituminous shale of middle Devonian age. They are approximately spherical, one to three feet in diameter, and possess a radial crystalline structure. An analysis of one of the concretions shows 88.42 per cent. of calcium carbonate, only 2.99 per cent. of magnesium carbonate, and the remainder consists of iron oxide, insoluble residue, hydrocarbons, and water. The most remarkable feature is the mechanical displacement and deformation of the enclosing shales which the growth of the concretions has involved. The pressure or "live force" of the growing concretion or aggregate of spherically radiating crystals has even been sufficient to induce a true slaty cleavage in the shale at some points. The main thesis of the author is to demonstrate that this great centrifugal pressure is compatible with the persistence of the capillary film investing the growing crystal or concretion and without which its continued growth would be impossible. The explanation, which, it would seem, must be generally accepted, is based upon the experiments of Jamin, leading to the conclusion that equilibrium may exist between two unequal pressures affecting the ends of a capillary tube, provided a column of liquid occupying the tube be interrupted by bubbles of air. The presence of the latter excites capillary attraction which is so strong as to take up several atmospheres of pressure applied at one end of the tube. The force so expended is represented in the compression of the air bubbles, and in changing the form of the air menisci; surface tension is thus overcome. The movement of the bubbles progressively decreases in the direction of the greater pressure until one is reached which is not disturbed at all so long as the pressure remains constant. The bubbles act like so many buffers. Any capillary tube filled with water interrupted by any insoluble gas or liquid possessing a lower surface tension than water, will exhibit the same phenomenon.

The Granitic Rocks of the Pikes Peak Quadrangle. By EDWARD B. MATHEWS. *J. Geol.*, **8**, 214–240.—The granites

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are regarded as of late Algonkian age; and four types are recognized, differing markedly in texture but agreeing closely in mineral and chemical composition. They are typical biotite granites, in which hornblende rarely occurs; and a mechanical analysis of the coarse Pikes Peak type gave: quartz, 33.4 per cent.; microcline, 53.3; biotite and all minerals with specific gravity above 3.0, 10.7; and oligoclase, 2.6; total, 100 00. The petrographic descriptions are accompanied by tables showing for the different types the relative abundance of the sixteen component minerals, and the relative size and development of the three essential constituents. Strangely enough, fluorite, which occurs in three of the four types and is very marked in the Summit type, is not mentioned as a constituent of the Cripple Creek type, notwithstanding its prominence as a feature of the Cripple Creek ore deposits. Another table gives the chemical composition of all but the Cripple Creek type, in four of Hillebrand's complete and careful analyses, with determinations of seventeen constituents. When the individual analyses and their average are reduced to molecular proportions and compared with analyses of other granites, the Pikes Peak granites are seen to be exceptionally rich in silica and potassium, as well as in fluorine; and the family likeness of these types suggests their origin in a common magma relatively rich in the elements named. Although this tends to make the relative ages of the types of little moment, it may be noted that on page 223 the Pikes Peak type is described as clearly the oldest; while on page 228 this distinction is assigned to the Summit type. The reviewer's observations in this field suggest the advisability of regarding the Pikes Peak type as the normal granite of the batholite; the Summit type and the Cripple Creek types as representing a once-continuous contact zone of the batholite in which the remnants of the Algonkian cover now chiefly occur; and the fine-grained type, which occurs only as dikes in the other types, representing residual magma intrusive in shrinkage and other cracks. According to this view the contact-zone types are the oldest and the fine-grained or dike types the youngest, while the Pikes Peak or normal type is intermediate, having solidified after the contact zone by which it is covered and before the dikes by which both it and the contact zone are intersected. As might be expected, the gneissoid phase is chiefly characteristic of the outer or border portions of the massif.

Igneous Rock-Series and Mixed Rocks. By Alfred Harker. *J. Geol.*, **8**, 389–399.—A rock-series is defined as an assemblage of rock-types, with a certain community of characters, associated in the same district, belonging to the same suite of eruptions and holding a similar position in the scheme of igneous rocks belonging to that suite. According to the differentiation hypothesis,

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they are derivatives of the same order from one common source, resulting from differentiation along similar lines and to the same degree. The fundamental characteristics of such a series, having regard to chemical composition, are of two kinds: (1) Those belonging to the individual rock-types and shared by all the types included in the series; and (2) those belonging to the assemblage of types as a whole, depending upon variations in the composition of the members as compared with one another. These characteristics admit of very clear graphic presentation. For this purpose the method of two equal rectangular coordinates first used by Iddings is recommended, silica being referred to one axis and bases to the other; and the resulting curves are briefly discussed. The origin of igneous rocks by admixture rather than by differentiation is next considered, and three principal cases are distinguished: (1) Mixture of two fluid magmas; (2) permeation of a solid rock by a fluid magma; and (3) inclusion of rock fragments in a fluid magma. The second and third cases are practically limited to igneous rocks of cognate origin; and the distinction of the included and permeated rocks or xenoliths as accidental and cognate is regarded as important, the latter only yielding by their absorption new rocks of any considerable extent or importance. Several cases are considered, including the admixture of two rocks of the same rock-series, and the solution by a magma of extraneous quartz, and of limestone. The admixture of the extreme types of a series will not, in general, give exactly any of the intermediate types. The rock analyses of Clarke and Hillebrand are cited in illustration of this principle; and it is pointed out that mixtures, even of two normal igneous rocks and still more of an igneous and a sedimentary rock, must often be abnormal in chemical composition. The relations of the chemical composition of the magma and of foreign admixtures to the mineralogical composition are also considered.

A Contribution to the Natural History of Marl. By CHARLES A. DAVIS. *J. Geol.*, **8**, 485–497. This valuable contribution to the chemistry of marl is based upon observations made in certain small lakes in Michigan; but the principles which it embodies undoubtedly admit of general application. The marl is nearly pure carbonate of lime, the source of which is to be sought in the solution by meteoric waters of limestones or other calcareous strata, the drift of limestone districts and, more remotely, the carbonation of lime-bearing silicates. The real problem is the deposition of this dissolved carbonate of lime in the form of white, chalky marl, which consists only to a small extent of shells or fragments of shells. After pointing out the inadequacy of animal life, evaporation and escape of carbon dioxide on relief of pressure, as causes of the precipitation of the carbonate of lime, the

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author discusses at length the only alternative hypothesis, namely, that the calcium salts are precipitated through the agency of plant life. In the marly lakes aquatic plants of all kinds become incrusted with calcium carbonate, which is not a true secretion of the plants, for it is purely external, and the same species in other districts are not incrusted. The deposit is formed incidentally by chemical precipitation upon the surface of the plants, probably only upon the green parts, and in performance of normal and usual processes of the plant organism. All green plants inhale carbon dioxide and exhale oxygen; and these are two possible causes of the calcareous incrustation. If the calcium carbonate is in excess in the water, and is held in solution by carbon dioxide, then the absorption of the latter by the plants causes precipitation of the carbonate upon the parts (stems and leaves) abstracting the gas. But if the proportion of calcium carbonate in solution is so small that it would not be deposited even if there were no carbon dioxide present, the precipitation is explained by the action of the oxygen set free by the living plants in converting calcium bicarbonate to monocarbonate: $CaH_2(CO_3)_2 + O = H_2O + CaCO_3 + CO_2 + O$.

Plants vary greatly in their power of precipitating the calcium carbonate; and the algae, and especially the Characes or Stoneworts, are most efficient. Analyses are given showing that plants may precipitate mineral matter equal to several or many times the weight of their own dried tissues, that this mineral matter consists of $CaCO_3$, 93.76; $MgCO_3$, 2.93; SiO_2, 2.40; Fe_2O_3 and Al_2O_3, 0.89 per cent. It is shown that the structure and distribution of the marl are entirely in harmony with the view that a species of Chara is an important agent in its formation; but it is recognized that a species of Zonotrichia has also played an important part, explaining, especially, the more solid and nodular forms of the marl.

A Remarkable Marl Lake. By CHARLES A. DAVIS. *J. Geol.*, **8**, 498–503.—This paper supplements the preceding, describing the truly impressive deposit of marl in Littlefield Lake, Isabella County, Michigan, and showing that it is unquestionably due to the precipitating agency of Chara and Zonotrichia, chiefly through the exhalation of oxygen.

The Composition of Kulaite. By HENRY S. WASHINGTON. *J. Geol.*, **8**, 610–620.—Kulaite is the name given by the author several years ago to a subgroup of the basalts in which hornblende occurs as an essential constituent and surpassing augite in quantity and importance. The original analysis by Röhrig showed, for basalts, abnormally high soda, as well as very high alumina and low magnesia. There seemed to be no mineral pres-

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ent which would account for the high alkalies, and to determine this and other points two new analyses were undertaken, one of normal kulaite, and the other of a leucite kulaite. The first showed, in comparison with Röhrig's analysis, about 2 per cent. more Fe_2O_3 and as much less K_2O; and the second differed rather widely except for the MgO, CaO, and Al_2O_3. It is surprising to find that all these differences are regarded as probably due to the different analytical methods used. The normal and leucite kulaites are found to agree closely except in the minor constituents TiO_2 and P_2O_5; and the author next considers the place in the classification indicated by this composition. The alkalies and alumina are shown to be too high for a true basalt; and for these reasons and also because of the higher SiO_2 and the lower iron oxides, MgO and CaO, they cannot be referred to the subgroup of hornblende basalts. They are, in fact, properly leucocratic, while the hornblende basalts are melanocratic; and the closest analogues of the Kala rocks are to be found among the nepheline-tephrites and the nepheline-basanites, notwithstanding that many of these are markedly lower in SiO_2, Al_2O_3, and Na_2O. A resemblance to the monchiquites is also noted, the main difference being the higher H_2O content of the latter. Except in the glassy varieties, the essential hornblende has been partially or entirely altered to hypersthene, diopside and magnetite. The component minerals are calculated from the analyses, and nepheline, the presence of which was indicated by the gelatinization and fuchsine tests, is fully confirmed. Certain anomalies of the mineral composition, such as a large proportion of orthoclase in the more basic type, and of leucite in the type running highest in SiO_2 and lowest in K_2O, are explained by reference to difference in pressure and rate of cooling; and the author favors basing the classification of this and other rocks directly upon the chemical composition.

Classification of Igneous Rocks According to Composition. By J. E. Spurr. *Am. Geol.*, **25**, 210–234.—The system of classification proposed here is an outgrowth of a study of a series of rocks collected by the author in Alaska. The system is presented in outline and elaborated only for the feldspar rocks. The principles upon which it is founded are, in the order of importance: (1) Mineralogy, (2) structure, (3) chemical equivalence. The feldspar rocks are divided, according to the nature of their feldspars, into three families, the first or granitic family characterized by alkali feldspars, with 63 to 68 per cent. of silica, the second or dioritic family by oligoclase-andesine feldspars with 56–63 per cent. of silica, and third or diabasic family by labradorite-anorthite feldspars, with 48–56 per cent. of silica. The monzonitic family is intermediate between the granitic and dioritic

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families, and the belugitic, similarly, between the dioritic and diabasic. The determination of the feldspars being indispensable, the principal methods are discussed. After the feldspars other minerals are considered, first qualitatively and then quantitatively. The ferromagnesian minerals, with the exception of olivine, are reckoned together. They occur throughout the rock series without excluding one another. The predominance of one ferromagnesian constituent over the others is recognized in the division of the groups, or in the species, the latter being designated by writing the characteristic ferromagnesian silicate before the name of the group. The same principle carried further gives the varieties under the species. The mineralogic class, family, group, species, and variety being thus established, the type, which is the actual designation of any given specimen is determined by the structure, which may be (1) granular hypidiomorphic or allotriomorphic, (2) panidiomorphic, (3) porphyritic (phenocrysts in a coarsely holo-crystalline groundmass), (4) porphyritic (phenocrysts in a micro- or cryptocrystalline or glassy groundmass), (5) wholly glassy. The granular structure is regarded as most normal, and the granular types receive the same general names as in the mineralogic classification. To these names are added, for the second type, the word aplite and for the third type the name porphyry; while for the fourth type, which includes the volcanics,- the accepted names of the lavas—rhyolite, trachyte, etc., are used; and for wholly glassy rocks the word glass is appended to these names. Age and geological occurrence are rejected as classificatory criteria; and after suggesting that the members of compound or polynomial rock names should be printed in different kinds of type, in order to indicate clearly the value of each, the author discusses at some length the general principles of rock classification, summarizing the views of other petrographers. The division of the feldspars into three main groups, instead of two (orthoclase and plagioclase) is shown to be more symmetrical as regards the silica ratio and other chemical relations. The paper concludes with an illustration in tabular form of the proposed system as applied to the igneous feldspar rocks of Alaska.

Mineralogical and Petrographic Study of the Gabbroid Rocks of Minnesota, and More Particularly of the Plagioclasites. By ALEXANDER N. WINCHELL. *Am. Geol.*, **26**, 151–188, 107–245, 262–306, 348–388.—This is a monographic study of basic igneous rocks covering an area of nearly 3,000 square miles in the northeast corner of Minnesota. The author accepts at the outset the conclusion of the state geologist, N. H. Winchell, that the gabbros are not of deep-seated eruptive origin but have been derived from the fusion of the great greenstone formation of the Lake Superior Archaean. The green stone is primarily of igneous

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origin, including both massive and clastic forms; and it is regarded as the oldest known terrane of the earth's crust, from which all the later formations of the region have been derived by refusion, the varied processes of metamorphism, and sedimentation. Stratigraphically, the gabbroid rocks are referred to, or constitute, the lower or Cabotian division of the Keweenawan, having originated in a great refusion of the Archaean greenstone at the close of Animikie time. The magma thus resulting consolidating at considerable depth produced gabbros of varying composition; consolidating in intruded laccolites and dikes it produced diabases; and finally as a surface rock it produced lavas and tuffs. The effusive rocks are not included in this study, which is limited to the following nine types: (1) Olivine gabbros, (2) normal diabase, (3) olivine diabase, (4) plagioclasite, (5) troctolite, (6) orthoclase gabbros, (7) cordierite norite, (8) quartz gabbro, (9) silicoferrolite. Each type is described in great detail, and numerous chemical analyses, partly original but chiefly quoted, show the composition of the rocks and their principal component minerals. The normal central type of this gabbro family is the olivine gabbro, from which the other types have been derived by variations due to (1) conditions of solidification, (2) magmatic segregation, (3) contact with other rocks and consequent absorption of foreign elements. These causes of variation are discussed at length, and the conclusion reached that to the first are due the normal diabase and olivine diabase, to the second the troctolite and plagioclasite, and to the third the cordierite norite, through the digestion of aluminous sediment, the quartz gabbro, through the digestion of silicious schists or quartzites, and the orthoclase gabbro through the digestion of a potassic rock; and, finally, the silico-ferrolite is believed to represent a sedimentary rock entirely recrystallized under the exomorphic actions of the gabbro rather than an integral part of the latter. In the section on comparative mineralogy, the mode of occurrence of each one of the forty-two component minerals is considered, nearly one-half of the species being regarded as primary constituents. The concluding section on the comparative chemical composition discusses, first, the methods of analysis, second, the results of analysis, calculated and tabulated to express various molecular and atomic relations, and, third, the application of the different methods of graphic representation to the chemical composition of igneous rocks.

Notes on the Geology and Petrography of Monhegan Island, Maine. By E. C. E. Lord. *Am. Geol.*, 26, 329–347.—The predominant rock of Monhegan is a coarse-grained, olivine-norite, composed in the order of abundance of plagioclase (50–90 per cent.), olivine, hypersthene, magnetite, diallage, and hornblende.

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Fluctuations in the relative proportions of the ferromagnesian constituents give rise to the subordinate types: troctolite, norite, olivine gabbro, and gabbro proper. These types represent slight phasal differences in the noritic magma which pass by gradual transition into hornblende-gabbro and gabbro-diorite. The continuity of these rocks is interrupted by coarse-grained segregations or schlieren and a series of acid and basic dikes. The petrographic descriptions are accompanied by analyses of the olivine-norite, hornblende-gabbro, gabbro-diorite, labradorfels, gabbro-pyroxenites, and of the plagioclase (identified as bytownite) and diopside. The dikes include an earlier basic series and later acid series. The former are allied geologically and mineralogically to the basic plutonics which they intersect and to which, apparently, they are restricted, while the latter consist of granitic and aplitic types belonging to a later period of eruption and in no way connected genetically with the Monhegan mass. The acid dikes, composed chiefly of albite>quartz>muscovite>orthoclase>garnet>apatite>magnetite, vary in texture from a fine-grained soda aplite to a coarse granular pegmatitic granite. The analysis of the aplite agrees very closely with that of a soda-granulite from California. The basic dikes are of special interest, as they may be taken to represent products of deep-seated differentiation peculiar to the norite magma. They vary between a hypersthene-gabbro (beerbachite or aplitic gabbro) and a gabbro-diorite (malchite or aplitic diorite). Olivine, the prevailing ferromagnesian constituent of the norite, is wanting in the dikes. An analysis is given for each type, showing that they are essentially identical in composition; and the mean of these analyses agrees very closely with the mean for the hornblende-gabbro and gabbro-diorite, from which we must infer that the dikes represent a textural more than a chemical differentiation of the magma, and that their intrusion was subsequent to the differentiation of these plutonics from the olivine-norite.

Some Contact Phenomena of the Palisade Diabase. By John Duer Irving. *School Mines Quart.*, **20**, 213–223.—This paper, which, after noting the gradation in texture, density, and mineral composition between the central and peripheral portions of this great trap sheet, is based chiefly upon the exposures of the upper and lower contacts afforded by the new tunnel of the New York, Susquehanna and Western Railroad, confirms in the main the work of Andreae and Osann, who, in 1892, studied the lower contact only as exposed by the West Shore Railroad. The earlier work recognized four metamorphic phases of the Triassic shale and sandstone, as follows: (1) Normal hornfels; (2) the same rich in tourmaline; (3) altered arkose containing green hornblende; (4) lime-silicate hornfels. To these Irving adds five others, three

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from the lower contact: (1) Normal hornfels rich in spinel; (2) lime-silicate hornfels containing brown hornblende; (3) normal hornfels containing "augen" and green hornblende; and two from the upper contact: (4,5) Hornfels and arkose hornfels containing richly scattered crystals of andalusite. Each type is described in detail, and the evidence is shown to strongly support the intrusive origin of the diabase, the andalusite and the fact that the hornstone a hundred feet above the upper contact is baked as hard as any below the sheet, being especially conclusive in this regard. Another contact type is believed to be a leucite hornfels, although the analysis shows it to be too high in alumina and soda, and much too low in potash for a pure leucite, the discrepancy being attributed to interstitial matter. Leucite has not been previously described as a contact mineral.

A Brief Review of the Titaniferous Magnetites. By J. F. Kemp. *School Mines Quart.*, **20**, 323–356; **21**, 56-65.—The known deposits of magnetic iron ore may be conveniently classified into two groups on the basis of chemical composition: the titaniferous and the non-titaniferous. This grouping not only corresponds to the chemical composition, but also to the geological relations and to the present utilization and non-utilization. Among the magnetic ores the non-titaniferous are to-day the only ones mined and smelted, and even their productiveness has decreased notably in recent years, because of the great influx of cheap and easily reduced hematites from Lake Superior. The Cornwall banks in Pennsylvania are almost the only large American magnetite mines now in active operation. The geological relations of the non-titaniferous ores are variable, and, in one place and another, they have resulted from very different originals and by strongly contrasted processes, but if titaniferous iron sands are omitted, the massive titaniferous ore-bodies may be said to be closely allied in character and origin wherever they have been studied. With one or two exceptions the titaniferous magnetites are associated, so far as known, with rocks of the gabbro family and furnish a distinct type of ore body, that is singularly uniform the world over. They constitute, in most cases, large irregular masses in the midst of intrusions of igneous rock and seem to have been produced by the segregation of fairly pure titaniferous iron oxide, either before or during the process of cooling and consolidation. In less common instances the entire mass of the dike or stock is so enriched with the iron-bearing mineral as practically to be considered an ore. Although the ores are not at present the objects of active mining, yet the quantity is so large and the iron afforded has such peculiar advantages of its own, doubtless owing to certain chemical elements generally present in the ore, that it seems improbable that they will long go

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without utilization. The wall-rocks, referred to as belonging to the gabbro family, form an extended series including anorthosite, true gabbro, norite, diabase, and peridotite. To them must be added the Brazilian nepheline-plagioclase rock and the nepheline-syenite at Alno, Sweden. In their mineralogical composition the ores involve both ilmenite and titaniferous magnetite. The latter may be strongly magnetic while high in TiO_2. The strong magnetism of some titaniferous magnetites shows the improbability of removing the titanium by magnetic concentration. In most cases, while the iron is increased in the concentrates by the elimination of the ferro-magnesian silicates, the titanium is also increased. In their chemical composition the ores are characteristic and marked. As a rule, but not invariably, phosphorus and sulphur are notably low or entirely absent. Vanadium, chromium, nickel, and cobalt are almost always present, and they may together amount to several per cent. Magnesia and alumina are often far in excess of what would be required for silicates, and then they are doubtless combined with more or less iron in spinels. Lime is of course involved in the presence of the pyroxenes and related minerals and manganese is often, but not invariably, at hand. This paper consists, after the brief introduction, of summary descriptions, in geographic sequence, of the chief deposits of titaniferous magnetite now known. The descriptions are accompanied by analyses to the number of more than one hundred and seventy, which illustrate for each region the range in composition. This work is thus a complete résumé, and the citations place the reader in command of the literature.

The Origin of Kaolin. By Heinrich Ries. *Trans. Am. Ceramic Soc.*, 2, Feb., 1900.—Kaolin is defined as any residual clay sufficiently free from iron to burn to a white or nearly white color, and derives kaolin from feldspathic minerals, in part through the agency of carbon dioxide and the ordinary weathering processes (shallow deposits) and in part, as suggested by von Buch and Daubreé, through the agency of ascending acid vapors, including chiefly hydrofluoric acid (deep deposits). Collins' experiment and analyses are cited in support of the latter explanation, but all the economic deposits of the United States are referred to the former. Kaolins containing undecomposed mica cannot be referred to the fluoric type. The practicability of correlating rational analyses of kaolin with the original minerals and the method of derivation is also considered.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 3.

ARTHUR A. NOYES, Editor.

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METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Mines and Mill of the Atacama Mineral Company, Ltd., Taltal, Chili. BY S. H. LORAM. *Trans. Am. Inst. Min. Eng.*, **29**, 488–502.—The gold occurs here in very finely divided particles in compact quartz and in fissures in the quartz in the form of spangles upon crystals of baryte and quartz. The ore averages $41.68 per ton; ores assaying under $14.00 per ton do not pay for treatment. There are about 15 per cent. concentrates; some ores contain scorodite (hydrous ferric arsenate). The method of treating is pan-amalgamation, separation of sulphurets, and cyaniding of tailings. The ore is broken in a crusher to ½-inch size and pulverized dry in a Gruson ball mill to pass an 80-mesh screen made of phosphor-bronze. A No. 4 mill is charged with 1320 lbs. of steel balls; it makes 25 revolutions per minute, requires 11 horse power, and treats 6½ tons in 24 hours. The wear of steel from plates and balls is 5.69 lbs. per ton of ore. The amalgamating pans (22 in number) are 5 feet in diameter and 3 feet deep; they are lined to within 6 inches from top and bottom with amalgamated copper plates, and have 4 discharge holes in the sides; of these the lowest is just below the bottom, (a channel in the casting leading to it), the next is 8 inches higher, and the other two are equally spaced. A pan is charged with 88 lbs. mercury, 1100 lbs. ore, and enough sea water to make a thick pulp, the charge being a little over 1 foot deep. The amalgamation lasts about three hours, the muller making 48 revolutions per minute; caustic soda is added if ores containing scorodite are treated. The pan is now filled with water and the amalgam settled for one hour. The sands are discharged through the holes in the sides and enter an agitator (a pan 5 feet in diameter and 5 feet deep, lined with copper plates) from the bottom and

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overflow at the top. One agitator serves 8 pans. From the agitator the sands are run into a spitzkasten which takes out the concentrates while the overflow passes over a blanket (8 feet long) into a sump whence a centrifugal pump delivers it to the tailings-heaps, where the sands settle, while most of the fine slimes run off to sea. The concentrates, assaying about $14.00 per ton, are weathered and returned to the pan. A pan is cleaned up once a week, when the copper plates are dressed, and the agitator once a month. The tailings average $5.66 per ton representing an extraction of 86.5 per cent. The bullion contains 516 parts gold and 358 parts silver in a thousand. The cyanide plant contains 6 leaching vats (18 feet in diameter, 6 feet, 6 inches deep), and 3 zinc boxes (10 feet, 9 inches long, 2 feet wide, 1 foot, 5 inches deep), having 8 compartments. A vat is charged with 45 tons tailings to which have been added 225 lbs. of lime. The ore is first washed for twelve hours with 10 tons of water containing 0.05 per cent. caustic soda and 0.01 per cent. potassium cyanide; the solution is drained off, passing through the zinc boxes. It is followed by a strong cyanide solution (0.3 per cent.) percolating for four hours, then come 10 tons of weak solution (0.1 per cent.) and lastly 5 tons of wash-water, the last of which, when drained off, contains 0.01 per cent. cyanide. The tailings are discharged by sluicing. A zinc box is charged with 70 lbs. of shavings and the solution passes through it at the rate of 3.3 gallons per minute. The solutions upon entering the boxes contain in 100,000 parts, 0.28 (caustic wash), 0.80 (strong solution), and 0.25 (weak wash) part gold, and upon leaving, they retain 0.1 part gold. The boxes are cleaned up once in ten days. The precipitate, containing about 29 per cent. mercury, is pressed and retorted; the retort gold is melted with borax soda, and sand giving ingots assaying gold 19, silver 21, copper 59, and zinc 1 per cent. The consumption of cyanide is 1 lb. per ton of tailings; the leached tailings assay $6.37 representing an extraction of 80 per cent.

The Purchase of Zinc Ores in the Joplin District. By W. G. Waring. *Eng. Min. J.*, 70, 38–39.—In the European zinc centers the ores are bought and sold upon an assay basis, the valuation being made according to certain formulae which custom has established as being fair to buyer and seller. In the Joplin district the ores have been, until about 1898, purchased exclusively by agents who, judging the blende concentrates by their general appearance, made their offers and took the risks. This one-sided arrangement became unsatisfactory to miners, and at present blende ores are bought on a fairer basis than the mere judgment of the buyer. The purchasing formula now in vogue is $V = WQ - (E + P)$ in which V = value of ore at mine, subject to deductions for lead (50 cents for each unit) and iron ($1.00

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for each unit above 1 per cent.), W = 80 per cent. of the number of pounds of metallic zinc contained in a net ton of dry ore, Q = the St. Louis spelter quotation per pound at time of purchase, E = cost of treatment including freight, expense ($10.50), P = smelter profit. This is = 100 Q with ore running over 60 per cent. zinc, with under 60 per cent. it is = 100 Q + (10 Q × 60 − A), the assay in per cent. Jig concentrates contain 1–4 per cent. water when shipped, coarse buddle or sludge-headings 10–12 per cent.; when fine, 12–17 per cent. Carbonate ores are still bought and sold in the old way.—An investigation of the losses of zinc in smelting made at one plant showed that 1 part of lime in blendic ore entailed a loss of 2 parts of zinc. The author found that one part of lime present in the ore as carbonate would retain in roasting 0.4–0.7 part sulphur.

The Sadtler Process for Treating Zinc-Bearing Ores. By THE EDITOR. *Eng. Min. J.*, **70**, 368–369.—Zinc ores containing over 5 per cent. iron cannot be satisfactorily distilled in the usual fire-clay retort, as the iron corrodes the clay, forming a slag which also scorifies zinc. In this process the retort receives a basic lining not readily attacked by iron or lead. In a trial-test with a furnace containing 30 retorts, oxidized ores were treated containing Fe, 16–30.5; Pb, 1.5–12.89; SiO_2, 2–9; Zn, 16.5–37.5 per cent; Ag, 5–17 ozs., and Au, trace. The loss in retorts was a small fraction of 1 per cent. as against 3 per cent. in Missouri, where blende concentrates with 3 per cent. iron are treated. The precious metals remained in the residue (which also retained 4.2–8.5 per cent. zinc) and served as a basic flux for the lead blast-furnace; the zinc (yield 70–84 per cent.) contained 0.52–1.12 per cent. of lead, and 0.06–0.12 per cent. of iron. It is believed that with a large furnace and regular work the yield in zinc will be 85 per cent. A carload of zinc shipped to a lead-desilverizing plant did as good work as the Missouri spelter. To the regular cost of roasting and distilling of blende there will have to be added from 8 to 12 cents for the lining of each retort, which is, however more than made up by the longer life of the lined retort.

Aluminum-Magnesium Alloys. By R. H. THURSTON. *Science*, **11**, 783–784.—In view of the appearance in the technical literature of publications on aluminum-magnesium alloys (*e. g.*, Mach's "Magnalium"), the author calls attention to his investigation published in 1893. Magnesium has a breaking strength of 22,250 lbs. per square inch; the elastic limit is 8,870 lbs., the elongation, 2.8 per cent. and the modulus of elasticity, 1,945,000. The following table gives the data on aluminum-magnesium alloys:

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Per cent. Mg.	Sp. gr.	Breaking strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Modulus of elasticity.
0	2.67	13,685	4,900	1,690,000
2	2.62	15,440	8,700	2,650,000
5	2.59	17,850	13,090	2,917,000
10	2.55	19,680	14,600	2,650,000
30	2.29	5,000	....	.....

The addition of magnesium to aluminum reduces the elasticity steadily with the increase of magnesium ; the alloy $\frac{1}{8}$ magnesium, $\frac{7}{8}$ aluminum is as brittle as glass. The author believes that the addition of small amounts of magnesium to aluminum will make useful alloys.

Reminiscences of the Early Anthracite Iron Industry. By S. THOMAS. *Trans. Am. Inst. Min. Eng.*, **29**, 901–928.

The Relative Desulphurizing Effect of Lime and Magnesia in the Iron Blast-Furnace. By O. R. FOSTER. *Trans. Am. Inst. Min. Eng.*, **29**, 562–568.—The paper is a record of experiments made in brasqued crucibles heated in a furnace using illuminating gas and forced blast, the highest temperature obtained being 1,550° C., as measured by the Le Chatelier pyrometer. The materials used were Swedish wrought iron (carburized in a graphite crucible, sulphurized with iron sulphides and siliconized with carborundum), chemically pure lime, magnesia and silica. The results indicate in a general way that sometimes lime is the better desulphurizer, sometimes magnesia.

Experiments with Titaniferous Ores. By A. J. ROSSI. *Eng. Min. J.*, **70**, 544.—The author desires to place on record the fact that he has succeeded in producing on a working scale some 20 tons of ferro-titanium and promises details regarding the process and the product later on.

The Effect of Heat-Treatment upon the Physical Properties and the Microstructure of Steel. By R. G. MORSE. *Trans. Am. Inst. Min. Eng.*, **29**, 729–751.—The basis of the experiments was a steel of the composition C, 0.343 ; Si, 0.027 ; Mn, 0.221 ; P, 0.0266 ; S, 0.0037. Bars 1 ft. long were heated to temperatures varying from 500° C. to 1300° C ; they were kept more or less time at these temperatures, then allowed to cool slowly, and the critical point, α_r, determined. They were tested for tensile strength and elastic limit and finally examined microscopically. The paper is accompanied by two diagrams and twenty-six micrographs.

The Relative Corrosion of Wrought Iron, Soft Steel, and Nickel Steel. By H. M. HOWE. International Congress, Methods of Testing Materials of Construction, through *Eng. Min. J.*, **70**, 188.—The paper gives the loss of weight of many

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plates of wrought iron, soft steel, and nickel steel (3 and 25 per cent. Ni) when exposed to sea water, to river water, and to the weather for two periods of about one year each. The inferences drawn from the results are: (1) "that the difference in the rate of corrosion between wrought iron and soft steel is rarely enough to be of great moment except, perhaps, in marine boilers, and (2) that the ratio of the corrosion of given soft steel to that of given wrought iron may vary greatly with the conditions of exposure." Wrought iron consists of ferrite containing mechanically intermixed some cinder in the form of flakes; soft steel, free from scales, contains cementite. Scale and cementite, resisting oxidation, mechanically protect the ferrite, and having a different potential than ferrite, may hasten or retard the corrosion. The resultant of these two forces must vary with the nature of the attacking medium. The following is a summary of the results of the author's experiments on the relative corrosion of soft steel, wrought-iron, and nickel steel, taking wrought-iron as a standard.

	Sea water.	Fresh water.	Weather.	Average.
Wrought-iron	100	100	100	100
Soft steel	114	94	103	103
3 per cent. nickel steel	83	80	67	77
26 per cent. nickel steel	32	32	30	31

Nickel Steel: A Synopsis of Experiment and Opinion. By D. H. Browne. *Trans. Am. Inst. Min. Eng.*, **29**, 569–648.

Carbide of Silicon in Cupola Practice—A New Softener. By F. J. Tone. *Foundry*, **16**, 117–118.—Carborundum has been found to be very satisfactory in foundry work, especially when dirty or burnt scrap forms part of the cupola charge. Already 1 per cent. carborundum has a marked influence upon the castings. In practice it is customary to charge the carborundum in lump or brick form on top of the coke that the iron, when melting, may be sure to come in contact with it. The heat of the cupola-metal is not sufficiently great to permit adding the carborundum in the ladle as is done in steel castings.

Malleable Cast Iron. By a Correspondent, *Eng. Min. J.*, **70**, 275–276.—The first record of the manufacture of malleable cast iron in this country is of that at Newark, N. J., about 1820. Good malleable castings show: Graphitic C, 3.20–4.00; combined C, 0.10–0.60; Mn about 0.25; S, not over 0.07; P, not over 0.250 per cent. The physical properties are: ultimate strength, 37,000 to 45,000 lbs. per sq. inch, elongation, 3–5 per cent. in 2 inches. For melting, the cupola, and the reverberatory without and with regenerative chambers, are in use. As cupola-metal is difficult to anneal, it is restricted to fine sections. Reverberatory furnaces hold 6–12 tons of metal. It takes about one hour to charge a 10-ton fur-

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nace, and four to six hours to melt a charge. The castings, after knocking off the gates, are cleaned in tumblers, sorted, packed with iron scale in pots and annealed for four to seven days. The malleableized iron is then again tumbled, the fins are ground off, and the goods shipped either directly or after first dipping into asphaltum thinned with benzene. The author enumerates the many uses malleable castings are put to and gives the names and productions of the leading firms of the country.

Annealing Malleable Cast Iron. By G. C. Davis. *J. Am. Foundrymen's Assoc.*, **8**, 93–104, 121–124; *Foundry*, **16**, 103–106. Discussed by R. Moldenke and H. M. Howe, *Eng. Min. J.*, **69**, 382.—The object of the author was to find out experimentally how far the generally accepted statements were true that white iron when annealed, increased in weight in spite of the large loss of carbon. He found that with a $\frac{1}{8}$ inch bar (Si, 0.60; S, 0.047; total C, 3.23), the increase in bulk was 10.29 per cent. and with a $\frac{3}{4}$ inch bar, 6.17 per cent.; the increase in weight averaged 6.29 per cent. The explanation of this increase in volume given by Moldenke and Howe is that the cementite (Fe_3C) of the white iron is converted in annealing into ferrite and bulky temper-carbon, the latter expanding the metal. The increase in weight is ascribed by the author to the reduction of some of the oxide of iron in the packing by carbon or carbon monoxide, and to its welding to the casting. The experiments showed also that considerable sulphur was absorbed in annealing, the gain in sulphur occurring principally at the surface; in a $\frac{3}{4}$ inch bar the sulphur content in the center remained unchanged, while it increased 0.035 per cent. in the skin ($\frac{1}{50}$ inch thick). The sulphur, the author points out, must have come from the mill-scale used in annealing, samples of wrought-iron scale showing 0.17–0.26 per cent., and of steel scale, 0.061–0.084 per cent. of sulphur.

Shrinkage of Malleable Iron Castings. By H. O. Evans. *J. Am. Foundrymen's Assoc.*, **8**, 125; *Foundry*, **16**, 121.—In discussing Davis' article (see above), Moldenke made the statement that the contraction in chilling, of irons used for making malleable castings, was $\frac{1}{4}$ inch to the foot and the expansion in annealing $\frac{1}{8}$ inch to the foot, leaving $\frac{1}{8}$ inch, the ordinary contraction allowed for gray iron. The author attacks this general statement. He shows that while the shrinkage due to the cooling of the white iron is a pretty constant quantity, the expansion due to annealing shows considerable variety, so that no hard-and-fast rule for the design of a pattern allowing for shrinkage can be made. In fact it has happened that the same pattern sent to different foundries gave castings differing slightly in their dimensions.

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INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

Some Recent Developments in Textile Processes. BY ARON HAMBURGER. *J. Franklin Inst.*, **145**, 453.—A full account of Mercer's invention, as set forth in his patent claims, is given, and then follows a description of the processes of mercerizing cotton fibers as now practiced. The manufacture of artificial silk according to the methods of Lehner and Chardonnet is discussed. It is stated that the tetranitrocellulose is the basis of the artificial fiber. The uses of formaldehyde in the textile industries also receives passing notice. By injecting a gelatine solution into a formaldehyde solution, threads are produced having a silky luster. The use of gelatine solution, followed by formaldehyde treatment, is considered in relation to sizing in color printing and for water-proofing. Formaldehyde is being experimented with in making souple silks, to fix or render insoluble the sericine and so prevent loss of weight in the various processes through which the silk passes in finishing.

The Technology of California Bitumens. BY S. F. PECKHAM. *J. Franklin Inst.*, **146**, 45–54.—This paper consists of a résumé of investigations and reports by the author and others upon the California bitumens, most of the work having been carried on some years ago. The crude oils were found to contain nitrogenous bodies, soluble in acid, which on further study proved to be pyridine and chinoline. A substance supposed to be a crude paraffin was shown to be a solid olefine or naphthene. The author believes, from his experiments, that these oils contain proportionally large amounts of benzene, and that this explains the difficulty of making good illuminating oils from the crude.

Ammonia and Its Sources. BY BRUNO TERNE. *J. Franklin Inst.*, **146**, 127–137.—The recovery of ammonia from by-product coke ovens is first considered, and it is shown that the Otto and Semet-Solvay ovens have a firm establishment in this country. The author inclines to the opinion that the Semet-Solvay oven is quicker in operation than its competitors. Putting the average of ammonium sulphate recovered at 20 pounds per ton of coal coked, the daily loss in the 45,000 bee-hive ovens of this country is over 2,000 tons of sulphate. The Mond gas producer with ammonia recovery is mentioned and the yield of ammonium sulphate put at nearly 100 pounds per ton of fuel. The utilization of sugar-house waste by igniting the molasses with alkali-aluminate, as well as several other processes of similar character, has not yet yielded practical results. Nor is the problem of

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utilizing atmospheric nitrogen for ammonia yet solved. The results of Lord Rayleigh's, and Siemens and Halske's experiments on the oxidation of nitrogen by the influence of the electric spark, show that an alkali must be present to unite with the oxides at the moment of formation. The experiments of Russell and Frank on producing nitrides by heating calcium carbide and magnesium, aluminum, or zinc powder, and also the production of nitrides in the electric furnace by the methods of Mehner and Willson, are briefly considered; these electric methods are favorably looked upon. The production of nitrogen in the soil by the action of bacteria cultures is considered to be yet in the experimental stage. The utilization of garbage as a source of fertilizer and of grease is prominently brought out; it is shown that the garbage of New York and Brooklyn alone will add to the annual output 2,400,000 pounds of ammonia in the form of fertilizer.

History of the Portland Cement Industry in the United States. By Robert W. Lesley. *J. Franklin Inst.*, **146**, 324–348.—The principles of hydraulic cement making were discovered by Smeaton towards the end of the 18th century. The first natural cements made by calcining and grinding suitable argillaceous limestones was made by Parker in 1796; in 1824 Aspdin produced the first Portland cement from a mixture of chalk and clay, calcined at a high temperature, and ground to fine powder. The natural cement industry was early started in this country and has continued to thrive to the present time. Portland cement was first made here in 1870, and the industry has now reached large proportions. The improvement of the rotary kiln gave a great impetus to the industry, while the introduction of other labor-saving devices and improved grinding appliances, notably the Griffin mill and tube-mill, have enabled American cements to displace, to a considerable extent, those of foreign manufacture. The author discusses the materials and their handling for the making of the cement, the chemical analysis of certain type cements, as shown by tables for eleven domestic and ten foreign brands, the testing of cement, and the growth of the industry as shown by statistics.

High Explosives and Smokeless Powders and Their Applications in Warfare. By Hudson Maxim. *J. Franklin Inst.*, **146**, 375–386, 457–464.—This paper is a discussion of the properties of various high explosives and a plea for their use in high-power guns and for large shells. Attention is directed to the well-known fact that increasing the density of an explosive diminishes its sensitiveness to detonating shocks; that guncotton in the fibrous state is readily detonated, but that, if dissolved and rendered hard and horny by evaporation of the solvent, it resists de-

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tonative influences. Fine granulation of such a material is necessary to insure complete burning, and this presents so much surface that dangerous pressures are reached in the gun if it be over four-inch caliber. A description of the Maxim-Schüpphaus smokeless cannon powder is given: A mixture of high grade guncotton containing a little soluble pyroxylin is rendered plastic with very little solvent and is molded into grains under heat and pressure; these grains, in drying, shrink but little and retain the shape of the die. Nitroglycerine may be added to the mixture, and is recommended in proportions of 10 to 25 per cent. The form of the grain is one of its chief features, it being multi-perforated, which is claimed to increase its ballistic power. The grain proposed for large charges is a cylinder six diameters long and pierced longitudinally by nineteen angular perforations. The exterior of the grain is coated with a non-combustible coating. Assuming, as an example, the 12-inch sea coast rifle, throwing a shell weighing 1,000 pounds at a velocity of 2,250 feet per second, on a pressure of 35,000 lbs. per square inch, it is claimed that a gun of 24-inch caliber and of same length as the 12-inch gun would show an average pressure just half that of the 12-inch gun; but the area of the base of the projectile being four times as great in this case, a shell of twice the weight of the 12-inch shell could be thrown at the same velocity. The additional weight could be made up of high explosive instead of the black powder now used. The last part of the paper deals with the economic and humane aspects of the "business of war."

A Process of Fire-Proofing Wood To Be Used for the Wood-Work of War Vessels. By C. J. Hexamer. *J. Franklin Inst.*, 147, 65–70.—The process consists in saturating the pores of the wood with a solution of water-glass and then decomposing it with a solution of ammonium chloride, by which gelatinous silica is precipitated in the pores of the wood. Well-seasoned, kiln-dried timber is put into a chamber, capable of withstanding strong pressure, and which can be heated externally by steam. The chamber is sealed, the temperature brought to 60° C., and kept there. The air is exhausted as thoroughly as possible with an air-pump; the solution, previously heated to 60° C., is then sprayed into the chamber until the wood becomes saturated, then the vacuum is broken, and a pressure of ten atmospheres is applied and kept up for three hours. This forces the liquid through the mass. It is insisted that steaming the wood previous to saturating it is injurious and prevents the thorough penetration of the liquids.

Methods for the Examination of Explosives. By W. J. Williams. *J. Franklin Inst.*, 147, 197–215.—The author first considers the "service tests," in which the stability of the powder under the influence of heat is determined. The powder is ex-

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posed to a temperature of 150° F. until indications of decomposition of the nitro-compounds are observed. Iodo-starch paper is used, which shows a brown or yellow color as soon as acids or nitrogen oxides are set free. The specific gravity is next determined by the use of mercury in a vacuum. The gravimetric density, or "ratio which the weight of the substance bears to the volume it occupies," is then determined in the DuPont gravimetric balance. The loss of weight, when heated at 130° F. for twenty-four hours, and the increase of weight when exposed to an atmosphere saturated with moisture for twenty-four hours, are also determined. The powder is then exposed in an air-tight box to great cold (—35° F. to —40° F.) for six hours, and any gain or loss in weight is noted. It is then exposed to the air for twenty-four hours and any gain or loss of weight determined. After each of these tests the powder is tested for the velocity and pressure when fired in the gun. The uniformity of granulation is determined by a set of sieves with circular perforations ranging from 0.10 to 0.03 of an inch in diameter. Lastly, the "fouling" capacity of the powder is found by burning it on a watch-glass and weighing the residue. The chemical tests are quite elaborate, including the determination of nitrogen by dissolving the powder in concentrated sulphuric acid, shaking with mercury, and measuring the volume of nitric oxide liberated. For nitro-substitution compounds, where this method cannot be used, a modified Kjeldahl or Gunning method is used. Moisture and volatile matter are determined by twenty-four hours' exposure in an air-bath at 50° C., followed by one day or longer in a vacuum desiccator over concentrated sulphuric acid or calcium chloride. The analysis of explosives is then explained, using guncotton as the type; then the analysis of a powder is explained. In an appendix the theory of the decompositions of guncotton, of nitroglycerine, and black powder is illustrated by reactions.

Graphite: Its Formation and Manufacture. By E. G. Acheson. *J. Franklin Inst.*, 147, 475–486.—The history, distribution, and uses of natural graphite are first discussed, and then the methods proposed for the artificial production are outlined. The greater part of the paper is devoted to the author's process of forming graphite in the electric furnace, by the decomposition of a carbide. As raw material he employs coke, and he has found as a result of his experiments that the pure coke from petroleum stills will form little or no graphite, while the best yield is obtained from impure coke made from bituminous coal. Only a part of the coke is converted into graphite. The first operation is the formation of the carbide and the second is its decomposition. The theory of formation is explained, and the author states his conclusions from his own experiments, as fol-

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lows : (1) Graphite is the form carbon assumes, when freed from chemical associations, under conditions of low pressure and protection from chemical influence. (2) Diamond is the form carbon assumes, when freed from chemical associations, under conditions of high pressure and protection from chemical influence. (3) Amorphous carbon is the form assumed when freed from chemical associations, under conditions of low or high pressure and exposure to chemical influences. It is also supposed that catalysis occurs, under certain conditions, during the transformation of amorphous into graphitic carbon. Then follows an account of the commercial operations under way for the development of the process for manufacturing graphite. It is also shown that a specific name for the new product is desirable, exception being taken to the word "artificial," since it conveys the impression that a cheap imitation is being palmed off as the genuine article. "Manufactured graphite" is also excluded, since it is now applied to the articles made of graphite.

The Laboratory Production of Asphalts from Animal and Vegetable Materials. By Wm. C. Day. *J. Franklin Inst.*, **148**, 205–226.—The author distilled a mixture of fresh fish (herring) and fat pine wood in an iron retort, and passed the products of distillation directly through a red hot iron tube and thence to a Liebig condenser. He obtained a yellowish-red aqueous distillate and a dark, nearly black, oil, most of which was lighter than water, although a part of it coming over towards the end of the process was heavier. The oil was dried and analyzed, and then distilled by itself in a glass retort. Five distillates were separated at 180°, 245°, 315°, and 340° C. and at 425° (estimated). There remained in the flask a black liquid which solidified, on cooling, to a mass resembling the natural gilsonite in composition and properties. Determinations of carbon, hydrogen, nitrogen, and sulphur, were made, and the solubility in carbon bisulphite, turpentine, ether, gasoline, and absolute alcohol was determined. All of the solutions showed a greenish fluorescence. The action of nitric acid on gilsonite and on the artificial product was similar. Basic compounds similar to pyridine and quinoline were obtained both from gilsonite and from the artificial product. Distillations of fish alone and of wood alone were made in the same apparatus and oil and water obtained. On redistillation this oil left a residue similar to maltha. On analysis it resembled natural elaterite. Basic substances were obtained from this oil similar to those from the gilsonite. The solubility was also studied. From the distillation of the wood a larger proportion of a strongly acid oil resulted. On redistilling, the same fractions were taken as previously, and the residue in the retort was a black liquid which solidified, on cooling, to a black mass,

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showing a purple color in thin edges. Tables of analyses and solubilities are given. No traces of basic substances could be found in these oils from wood alone. Comparative tables of analyses, specific gravities, and solubilites of gilsonite and elaterite, and of these artificial oils, are given. A lengthy discussion of the origin of natural asphalts and bitumens, and of petroleum, follows. The author inclines to the idea that no one theory can explain all of the known occurrences of different bitumens.

What is Parianite? A Correction. By H. Endemann. *J. Franklin Inst.*, **149**, 314.—The author explains an error, due to a misapprehension in Keller's contribution to the discussion of the paper by S. F. Peckham (*this Rev.*, **6**, 124). From the reading of the report it would appear that the author had made no attempt to isolate compounds of definite composition from asphalt generally, whereas he had merely neglected the petrolenes, these being the subordinate portion of asphalt. He has given his attention chiefly to the solids of asphalts.

Recent Progress in the Aluminum Industry. By Joseph W. Richards. *J. Franklin Inst.*, **149**, 451–459.—This is an abstract of a lecture before the Institute. But little is said concerning the metallurgy of aluminum, the greater part of the paper being devoted to its commercial uses. It is shown that alloys of aluminum are relatively cheaper than brass, bronze, or copper, considering the difference in specific gravity. The only metals that are cheaper than aluminum are iron, zinc, and lead. It is rapidly replacing brass and copper for artistic effects, while for culinary utensils, toilet articles, and novelties, its use is steadily increasing. For fruit-jar caps it is replacing zinc, although more expensive. For lithographic printing, aluminum plates are superseding the time-honored stone ; they give fully as fine work and may be used on cylinder presses, thus allowing much faster running. For electric conductors aluminum is replacing copper, and promises to seriously affect the copper industry in this respect. Powdered and leaf aluminum has entirely replaced silver for decorative uses, and is also proving useful in the reduction of refractory metallic oxides; in this way, manganese, chromium, tungsten, vanadium, uranium, boron, and molybdenum have been reduced and utilized in alloys for steel making.

Aluminum: Considered Practically in Relation to Its General Application in the Arts and Mechanics. By Joseph A. Steinmetz. *J. Franklin Inst.*, **150**, 272–284.—This is a somewhat more extended, but similar, article to that by Richards (see above). The use of aluminum in the metallurgy of steel is noted, and also its use for making patterns. For models and salesmen's samples, the lightness of the metal makes it well

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adapted. The difficulty of soldering it is mentioned and some of the causes of failure pointed out. The statistics of the industry are given. An instance of the failure of aluminum for bath-tub making, owing to corrosion by soap and alkali, is shown; and for plumbing fixtures the metal is generally unsuitable. The metal finds use in making steam-jacketed pans for sirup, honey, fruit-juices, etc. The uses of the metal for electrical work and for cooking utensils, and its employment in ship building, are fully explained. Aluminum powder and its uses are considered; among these, it is mentioned that it can replace magnesium for flash-lights in photography.

The Occurrence of Fuller's Earth in the United States. By DAVID T. DAY. *J. Franklin Inst.*, **150**, 214–223.—The characteristics of the material are first considered. The different specimens of earth vary in composition, and no definite mineral substance of distinctive character can be found in all varieties. Any form of clay, which is capable of absorbing considerable quantities of liquids, which crumble in water and diffuse readily, and which will remove grease from wool or coloring-matters from oils, is a fuller's earth. The developments in the United States are then mentioned, and it is shown to be widely distributed. The conditions of its occurrence and its preparation for market are explained. The methods of using it for bleaching mineral and vegetable oils are stated, and it is suggested that, since the oils of different density in such a mixture as crude petroleum percolate through it at different rates, the first runnings being of lighter color and of lower specific gravity than those which follow, there is a possibility of separating such oils without fractional distillation, and hence without the production of decomposition-products. A table of analyses of a number of samples of the earth is also given.

The Influence of Science on Modern Beer Brewing. By FRANCIS WYATT. *J. Franklin Inst.*, **150**, 190–214; 299–320.—The author begins with a history of the development of the brewing industry. With the coming of the chemist into the brewing industry it was found that malt contained more diastase than is needed to hydrolyze its own starch, and that some of the troubles of the brewer were due to excessive quantities of nitrogenous bodies in soluble form in the beer. Hence came the use of raw grain to utilize the diastase and, by creating a greater mass of material, to diminish the proportion of proteids in the beer. The nature of the water used was also early recognized as important and its complete analysis is now customary. It is generally asserted that the sum of the quantities of earthy sulphates and carbonates should never exceed 100 parts per 100,000. Iron in quan-

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tities greater than 0.5 part per 100,000, is objectionable and should be removed. But a moderate amount of permanent hardness is desirable in the water, and by adding hardening salts soft waters may be improved. The bacteriological examination of the water is briefly explained. The properties and constituents of malt are considered and figures given showing the decrease of diastatic power, as influenced by the kilning process. The influence of temperature on the mashing process is explained, and it is shown that chemists have taught the brewers to use care in attaining a proper temperature in the mash. The use of starchy or saccharine materials, called malt-substitutes or malt-adjuncts, is now general and has resulted in an improved quality of the beer; cereals are specially prepared for this use, while grape-sugar and glucose have long been favorite materials. Raw cereals must be gelatinized at high temperatures to liberate the starch from the cells, before being subjected to the action of the malt at the lower temperature of the mash-tub. Hops are now subjected to analysis; the percentage of water and tannin are determined, as well as the condition and quantity of the lupulin and the amount of extract yielded to petroleum ether, chloroform, and water. Yeast and its properties and the effects of wild yeast and bacteria are then described. The author states the theory of alcoholic fermentation as formulated by Pasteur, and also the new theory of Buchner, that the decomposition of sugar into alcohol and carbonic acid gas is independent of vital action, being produced by a functional product of the yeast cell, an enzyme, which is excreted during its growth, and called zymose. A method for its preparation is given, and it is described as a clear but opalescent yellow fluid with the odor of yeast and a minimum specific gravity, 1.0416. A description of a modern brewing plant is given, and the changes which take place during the mashing are considered. An outline of the brewing process follows, and analyses of the wort with and without raw grain, and of the finished beers from these worts are shown. It is demonstrated that the character of the components of both beers is identical; that the differences in their composition are only those intentionally created, and that the modern scientific brewer may change the nature of his beers at will; that he can foretell the result to be obtained by the use of any process he may adopt. The chief points to be looked for in the worts are then clearly stated. The effect of reduced temperatures in precipitating soluble nitrogenous bodies of the albumose and peptone types is explained. Statistics of the industry in the United States since 1868 and a recapitulation of data in the paper, close the article.

Water-Softening Plant at the Lorain Steel Company's Blast-Furnaces. By N. O. Goldsmith. *Power*, **20**, No. 10.—This is

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mainly a description of the mechanical plant for an intermittent settling process of water purification. It includes an analysis of the water of Black River, Ohio, and also a series of analyses of the water before and after treatment for a period of three months, showing the reduction in the amount of lime and magnesia by treatment. A table of the cost of precipitating 1,000 grains of different impurities with different reagents is also included.

Note: On Carborundum. By Chas. F. Mabery. *J. Am. Chem. Soc.*, **22**, 706.—Attention is here called to the fact that the U. S. Circuit Court of Appeals has decided in favor of the patent of A. H. and E. H. Cowles, Dec. 24, 1884, and against that of E. H. Acheson, thus determining the question of priority for the incandescent method of reducing ores and other substances.

Portland Cement—Sketch of Materials and Process. By S. B. Newberry. *Eng. Record*, **42**, 436–438.—The subject is discussed under the heads: Introduction, Materials, Proportions of Ingredients, Mixing, Burning, Grinding. The three general classes of hydraulic cements, Portland cement, Natural cement, and Puzzalona or slag cement are defined. The materials for Portland cement are considered in detail and several analyses of carbonate of lime and clays used for cement are included. Under the proportions of ingredients the formula of Le Chatelier is given together with the author's formula based on his own experiments; thus from the formula

$$X(3CaO.SiO_2) + Y(2CaO.Al_2O_3),$$

he deduces the following rule for calculating the amount of lime required for any particular clay of which an analysis has been made: Multiply the percentage of silica by 2.8 and the percentage of alumina by 1.1; add the products; the sum equals the number of parts of lime required for 100 parts of clay. An example of the use of the formula is given. The author's experiments show that magnesia forms with clay no products having hydraulic properties, hence in calculating cement mixtures only the silica, lime, and alumina are considered. The methods of mixing are briefly explained, the semi-wet process being considered preferable. Under burning, the four types of kilns used for Portland cement are discussed. In this country the rotary kiln is preferred owing to its low labor account, but it is very wasteful of fuel. Le Chatelier's theory of the changes caused by the burning is stated, and the peculiar effect of sudden cooling of the hot clinker is noted. For grinding the clinker, the Griffin mill and tube-mill have generally replaced buhr-stones in this country. The fineness is such that 92–93 per cent. will pass a No. 100 sieve. It is claimed that the average tests of American cements are higher than those of English or German make.

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The Michigan Alkali Co.'s Plant for Manufacturing Portland Cement from Caustic Soda Waste. By B. B. LATHBURY. *Eng. News*, 43, 373. **The Raw Materials for the Manufacture of Portland Cement.** *Editorial, Eng. News*, 43, 376.—These two articles are in a measure complementary; the first is chiefly devoted to the engineering features of cement manufacture, but it includes analyses of the "waste" employed and also of the clay and of the limestone from which the lime is prepared for use in the causticizing plant. The second article is a compilation of facts relating to the materials, including tables of analyses of them and of representative foreign and domestic cements from various sources.

How to Calculate the Proper Cement Raw Mixture from the Given Raw Materials. By W. MICHAELIS, JR. *Cement and Eng. News*, 9, 21.—This is chiefly a review of the work of W. Michaelis, Sr., in determining the "Hydraulic Modulus." A formula is given, and the use of this modulus in calculating the ratio of clay to chalk from the analyses of the raw materials is illustrated by an example.

Chemical Industry of Germany. By R. GUENTHER. *U. S. Consular Rep.*, 64, 186.—The chief features of this report are a table of German imports and exports of chemicals for the years 1898 and 1899, and a table of exports to the United States in 1898. The United States then imported $8,383,000 worth of chemicals, exclusive of a large number of chemicals whose value is not stated.

Cellulith. By R. GUENTHER. *U. S. Consular Rep.*, 64, 461.—This is a short description of the method of making cellulith from paper pulp. The finished product, which has a specific gravity of 4.5, has the consistency of horn, and when incorporated with sawdust and lampblack, resembles ebonite.

Silver-Mounted Ware a Menace to Health. By WALTER SCHUMANN. *U. S. Consular Rep.*, 64, 374.—A Franfort newspaper is quoted to the effect that the silver on the mountings on certain glass and porcelain wares is applied by a galvanoplastic process, using baths strongly charged with potassium cyanide. It is claimed that the poison enters the fine cracks and crevices of the glazed ware, remains there, and is a source of danger in the use or handling of the articles. A case of poisoning is stated to have been traced to such a source. These goods are stated to be chiefly exported to the United States.

New Substitute for Gutta Percha. *U. S. Consular Rep.*, 64, 369.—The composition of the new substitute is secret. At ordinary temperatures the substance is hard and firm, but not brittle; it may be hammered without breaking. It softens on warming, but is not affected by water.

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Chemical Foods in Germany. By O. J. D. Hughes. *U. S. Consular Rep.*, 64, 23.—This contains a short list of the more important artificial food-products containing albuminose bodies.

New German Glass. *U. S. Consular Rep.*, 64, 131.—"Theophilus glass" is the name of a new material which, like the "Tiffany glass of this country," is intended for artistic uses.

Composition of the Ashes of Some Raw Tanning Materials. By Wm. K. Alsop and J. H. Yocum. *J. Am. Chem. Soc.*, 20, 338–340.—Tables are given showing the composition of the tanning material and giving complete analyses of its ash. The materials examined were chestnut-oak bark, hemlock bark, quebracho wood, and oak-bark extract.

Killing Weeds with Chemicals. By L. R. Jones and W. A. Orton. *Vt. Agr. Expt. Sta. Rep.*, 1899, 182–188.—The authors have tried the effects of salt, copper sulphate, potassium sulphide, sodium arseniate, arsenious oxide mixed with sal soda, kerosene, crude carbolic acid, and some other substances, in killing weeds in gravel walks, tennis courts, and other dry beaten soils. About 8 gallons of solution were applied to each square rod of area, the weeds chiefly present being knotweed, grasses, plantain, dandelion, and others. Knotweed was hardest to destroy. Salt requires heavy application, in the dry form, and is liable to be washed onto neighboring lawns and borders; crude carbolic acid is quick and powerful, but not enduring. Arsenical compounds, especially sodium arseniate, are effective, but their use depends upon convenience and expense.

Analyses of Fertilizers. *Mass. (Hatch) Agr. Expt. Sta. Rep., 1899*, 108–122; *Bull.* 65; *N. H. Agr. Expt. Sta. Bull.*, 69; *N. Y. Agr. Expt. Sta. Bull.*, 173, 531–552; *Vt. Agr. Expt. Sta. Rep.*, 1899, 148–150; *W. Va. Agr. Expt. Sta. Bull.*, 63, 115–152; *Wis. Agr. Expt. Sta. Bull.*, 81; *N. Da. Agr. Expt. Sta. Rep.*, 1899, 13–14; *Wash. Agr. Expt. Sta. Bull.*, 40; *N. J. Agr. Expt. Sta. Rep.*, 1899, 17–85; *Me. Agr. Expt. Sta. Bull.*, 60, 23–30; 66, 117–132; *Mass. State Board Agr. Rep.*, 1899, 131–169; *Md. Agr. Coll. Quart.*, 1900, 67; *R. I. Agr. Expt. Sta. Bull.*, 60, 67, 70, 73; *S. C. Agr. Expt. Sta. Bull.*, 53, 54; *Ky. Agr. Expt. Sta. Bull.*, 85, 88.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

C. H. Warren, Reviewer.

Action of Ammonium Chloride upon Analcite and Leucite. By F. W. Clarke and G. Steiger. *Am. J. Sci.*, 159, 117–124.—The article records the results of an investigation on the action

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of ammonium chloride upon the minerals analcite and leucite when the latter are heated separately with this reagent in sealed tubes at 350° C. ; also the meaning which the results obtained have in regard to the chemical constitution of the two minerals. Both minerals suffer a substitution of their alkali by ammonium, yielding the same compound whose composition is that of an ammonium leucite, $NH_4AlSi_2O_6$. This fact is believed to indicate an original similarity in the two minerals, which is also borne out by crystallographic and other resemblances. A further study of the chemical properties of the ammonium derivative leads the authors to think that analcite and leucite are not true metasilicates, but either salts of a polymeric metasilicic acid or a mixture of ortho- and tri-silicates.

Chemical Study of the Glaucophane Schists. By H. S. WASHINGTON. *Am. J. Sci.*, **161**, 31–59.—A consideration of the chemical and mineralogical composition of the above class of metamorphic rock as shown by a series of admirable chemical analyses of specimens from some seven localities, leads to conclusions concerning their classification and origin, which are briefly and concisely given by the author in his summary as follows : "The Glaucophane schists belong to two main groups, sharply separated from each other. The larger one is basic, composed chiefly of glaucophane and epidote, often with abundant garnet, zoisite, diallage, and sometimes smaller amounts of mica, feldspar, and quartz, and rutile and titanite as frequent accessories. Chemically, these closely resemble the composition of the rocks of the gabbro family, and are apparently divisible into two subgroups, one high in lime the other low in it. These are in most cases amost undoubtedly derived from such igneous rocks or their tuffs, but also possibly in rarer cases from sediments or slates of similar composition. These basic glaucophane schists scarcely differ in composition from the amphibolites and eclogites, and the difference in their formation is probably to be ascribed to differences in the conditions of metamorphism. A smaller, but widely spread, group is acid in composition, and these are composed largely of quartz and glaucophane, with mica and sometimes albite. These are derived from cherts, quartzites, or quartzose shales and sandstones. The existence is indicated of a third, still smaller, group of intermediate mineralogical composition, and chemically like the diorites. The glaucophane schists are apparently the result of both regional and contact metamorphism, and in many regions they occur together. This last seems to be the rule in glaucophane schist areas of any size, and where only the one kind is found the area is apt to be small."

The Mode of Occurrence of Topaz near Ouro Preto, Brazil. By ORVILLE A. DERBY. *Am. J. Sci., No. 165*, 25–34. The arti-

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cle gives the results of a study of the associated earths and rocks where the topaz is found. The mineral itself is found in a dark-colored earth, which is thought, from its mineralogical character and its geological relations, to represent the remains of an igneous dike in which the topaz was an original mineral. What the exact nature of the igneous dike was cannot be told on account of its extreme state of alteration.

Carnotite and Associated Vanadiferous Minerals in Western Colorado. By W. F. Hillebrand and F. Leslie Ransome. *Am. J. Sci.*, 160, 120–144.—The paper embodies the results of investigations concerning the occurrence and nature of the uranium and vanadium ores of Western Colorado. A somewhat detailed description of the various ore deposits is given by Dr. Ransome from a study of the region made by him and A. C. Spencer. He concludes that the ores are recent impregnations in the sandstones. The chemical researches made and recorded by Dr. Hillebrand furnish not only valuable data concerning the composition of the ores and their constituent minerals, but afford the chemist excellent descriptions of the analytical methods involved in the analysis of the uranium and vanadium ores. The summary made by the authors is as follows: "The body called carnotite is probably a mixture of minerals of which analysis fails to reveal the exact nature. Instead of being the pure uranyl-potassium vanadate, it is to a large extent made up of calcium and barium compounds. Intimately mixed with it, and entirely obscured by it, is an amorphous substance—a silicate or mixture of silicates—containing vanadium in the trivalent state, probably replacing aluminium. The deposits of carnotite, though distributed over a wide area of country, are, for the most part, if not altogether, very superficial in character and of recent origin. The green coloring and cementing material of certain sandstones near Placerville, Colorado, is a crypto-crystalline alumino-vanadio-potassium silicate resembling roscoclite, but with the percentage proportions of Al_2O_3 and V_2O_3 reversed. It constitutes over 25 per cent. of the sandstone at times, and contains nearly 13 per cent. of V_2O_3, the latter amounting in the maximum case observed to 3.5 per cent. of the sandstone. As yet these highly vanadiferous sandstones have been found only at Placerville, where it is intended to work them for vanadium. Carnotite is associated with them in only trifling amount. Other sandstones noticed owe their bright green color to chromium. In yet another case, where the color was dull green, this was not due to either chromium or vanadium.

Notes on the Tellurides from Colorado. By Charles Palache. *Am. J. Sci.*, 160, 419–427.—The article gives the results of a careful and admirable crystallographic study of the

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mineral sylvanite, together with a chemical investigation of the same. The analyses show the composition to be represented by the formula $AuAgTe_4$, thus confirming the conclusions previously reached by Pearce from analyses made by him on massive material from Cripple Creek. The goldschmidtite of Hobbs is shown by the author to be identical in crystallization with sylvanite. Owing to this identity it is thought that the analyses made by Hobbs may have been rendered inaccurate by the extremely small quantity with which he worked, and in a note incorporated in the article, Prof. Hobbs withdraws the name goldschmidtite as representing a distinct species. The article is concluded by a note on the crystal habit of hessite from Boulder, Colorado.

Mohawkite, Stibio-Domeykite, Domeykite, Algodonite, and Some Artificial Copper Arsenides. By GEORGE A. KOENIG. *Am. J. Sci.*, **160**, 439–448.—The copper arsenides occurring in the Keweenaw copper formation of Michigan are found only in veins intersecting the bedded deposits of native copper, and have so far been observed only near the foot of the formation toward the southeast. The new mineral mohawkite occurs in a vein at the Mohawk Mine associated with other copper arsenides in a gangue of quartz and calcite. The mineral is massive, structure granular to compact, color a gray, tinged with yellow, taking readily a brassy to purplish tarnish. It is brittle, hardness about 3.5, with a specific gravity of 8.07. A chemical analysis gives its composition as follows: Cu, 61.67; Ni, 7.03; Co, 2.20; Fe, trace; As, 28.85; this gives the mineral the formula $(Cu,Ni,Co)_3As$. The author shows also that nickel and cobalt are present in small quantities in the mineral domeykite Cu_3As, and that the specific gravity of the latter should be 7.94 instead of 6.7 to 7.5, as given by the mineralogies. By volatilizing arsenic over red hot copper in a combustion tube, sealed at one end, two arsenides were obtained, one having the composition Cu_2As and resembling chalcocite, the other consisting of groups of minute crystals and identical with domeykite in composition. By the name stibio-domeykite the author designates a mineral from the Mohawk Mine, closely resembling domeykite but containing a small percentage of antimony, and by the name mohawk-whitneyite a very intimate mixture of the two minerals mohawkite and whitneyite. The results of several analyses of these last mixtures accompany the article. The correctness of the formula $(Cu,Ni,Co)_4As$, which was assigned to mohawkite by Ledoux (*Eng. Min. J.*, April, 1900) is strongly denied by the author. He concludes his with a new analysis of algodonite, confirming the formula Cu_6As. Its specific gravity was found to be 8.383, instead of 7.62, as previously given.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 4.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H Thorp.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

On the Behavior of Acylthioncarbamic Esters with Alkyl Iodides and Amines: Benzoylimidothiocarbamic Esters, Acyclic Benzoylpseudoureas and Benzoylureas. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, 24, 189–221.—The acylthioncarbamic esters used in the investigation were prepared by the union of acyl rhodanides with alcohols. It was found that these compounds have little tendency to undergo molecular rearrangement with alkyl iodides, and that this rearrangement took place only in the case of the acetyl and benzoyl methyl esters when warmed, within narrow limits, with methyl iodide. The thion compound was converted into a thiol derivative, $CH_3CO.NH.CS.OCH_3 \rightarrow CH_3CO.NH.CO.SCH_3$. The thiol derivative was also prepared by warming methyl thiolcarbamate with acetic anhydride. The results show that the compounds formed by the union of acyl rhodanides and alcohols have the thion and not the thiol structure which is assigned to them in Beilstein's "Handbuch." It was found that methyl benzoylthioncarbamate reacts more readily with chloracetic acid than with alkyl iodides, giving benzoylcarbaminethioglycollic acid, $C_6H_5CO.NH.CO.SCH_2.COOH$. In previous papers by the authors it has been shown that such thioncarbamic esters as have a more or less positive nature, such as the phenylthioncarbazinic ester, $C_6H_5NH.NH.CS.OC_2H_5$, readily react with alkyl halides and with compounds of a negative character; while, on the other hand, they proved to be quite inactive with organic bases. It is now shown in the case of the negative benzoyl thioncarbamic esters, that the behavior is the reverse. These compounds react with ammonia and organic bases at ordinary temperatures, form-

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ing direct, more or less stable, addition-products, which break down in a variety of ways, dependent upon the character of the amine radicals. As it was suspected that acyl pseudourea ethers were formed in some of the decompositions, compounds of this class were prepared from benzoylimidothiocarbonic esters, and studied. These latter compounds, $C_6H_5CO.N:C.SR.OR$, are readily formed by the action of alkyl iodides on the sodium salts of the benzoylthioncarbamic esters, and are oils, which boil under diminished pressure without decomposition. With water, they give benzamide, carbon dioxide, an alcohol, and a mercaptan. They are converted by hydrogen sulphide at 100° into benzoylthioncarbamic esters, and by dry hydrogen chloride into benzoylthiolcarbamic esters. When benzoylimidothiocarbonic esters are treated with organic bases they readily react, giving off mercaptan and forming acylpseudourea ethers:

$$C_6H_5CO.N:C\begin{matrix}SR\\ \diagup\\ \diagdown\\ OCH_3\end{matrix} + HNR'R'' =$$

$$C_6H_5CO.N:C\begin{matrix}NR'R''\\ \diagup\\ \diagdown\\ OCH_3\end{matrix} + HSR.$$

The compounds of this type are oils, which cannot be distilled without decomposition. They resemble closely in properties the acylimido esters and acylamidines, to both of which series the compounds belong. The most striking reaction of these pseudourea ethers is the reaction with hydrochloric acid. With this reagent the ethers react in the cold; alkyl chlorides are given off, and they are quantitatively converted into well-crystallized acylureas. The results show that the more negative the character of the radical in the imido ester grouping, $RN:CR'.OR''$, the more sensitive are the compounds in regard to decomposition with hydrochloric acid. The acylthioncarbamic esters react with phenylhydrazine, giving off hydrogen sulphide in the cold. Ring compounds are formed and obtained. This was proved by converting the compound represented by formula I from methylbenzoylthioncarbamate into the so-called 1,5-diphenyl-3-oxytriazole which is represented by formula II.

I. $$\begin{matrix}C_6H_5.C=N-C.OCH_3\\ \quad\quad |\quad\quad\ \ \|\\ C_6H_5.N-\!\!-\!\!-N\end{matrix}$$

II. $$\begin{matrix}C_6H_5.C=N-CO\\ \quad\quad |\quad\quad\ \ |\\ C_6H_5.N-\!\!-\!\!-NH\end{matrix}$$

The preparation and properties of a large number of compounds are described.

Camphoric Acid—Structure and Configuration of Cistrans-campholytic Acid. By William A. Noyes and Edward F. Phillips. *Am. Chem. J.*, **24**, 283–291.—From a study of the

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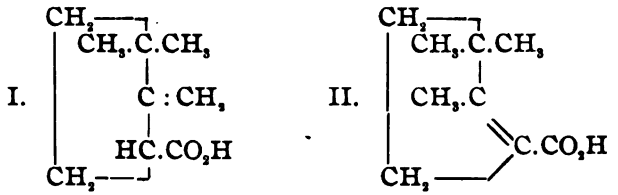
action of hydrobromic acid on cistranscampholytic acid, the authors have come to the conclusion that the formula proposed by Blanc and by Bouveault, formula I. for this acid can no longer be considered correct. When cistranscampholytic acid is treated



with hydrobromic acid, it is converted into an acid which in all probability is identical with the acid formed from dihydrohydroxycampholytic acid and hydrobromic acid; for the two bromacids have the same point of fusion and almost identical rotatory power. As this fact cannot be explained on the assumption that formula I is correct, the authors propose formula II for cistranscampholytic acid, and show that by means of it the properties of the acid can be explained. The acid is optically active, although the formula given above does not contain an asymmetric carbon atom. This, according to the authors, is not necessary. By the method of writing the formula "it is intended to indicate that the doubly united carbon atoms no longer lie exactly in the plane of the other three atoms of the ring, but are thrown slightly out of that plane, the one on one side, the other on the other. The carboxyl and methyl groups connected with the same atoms will, in such a case, lie on opposite sides of the ring. A compound of this configuration has no plane of symmetry and may exist in a right-handed and a left-handed form." The rotatory powers of dihydroaminocampholytic acid, dihydrohydroxycampholytic acid, cistranscampholytic acid, and β-bromdihydrocampholytic acid are given.

The Hydrolysis of Acid Amides. By Emmet Reid. *Am. Chem. J.*, 24, 397–424.—The results of the study of the rates of hydrolysis of a number of substituted benzamides with hydrochloric acid and barium hydroxide are given. The experimental methods used were like those employed in an earlier investigation on the same subject (*this Rev.*, 5, 71) and the results obtained are in the main in accord with those already reported. It was found that, with one exception, substituted benzamides having groups in the meta and para positions are hydrolyzed by hydrochloric acid, more slowly than benzamide. With all the groups the nature is of more importance than the weight of the group; *e.g.*, NH_2 retards more than NO_2 or bromine, and almost as much as iodine, when all are in the para position. Groups in the ortho position have a marked retarding influence on the hy-

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drolysis. Iodine, bromine, and chlorine in this position retard the reaction to the extent of 95, 92, and 85 per cent., respectively. The influence of a hydroxyl group is also great, but this is greatly reduced by substituting its hydrogen atom by radicals. At the same concentration barium hydroxide was found to act between five and ten times as fast as hydrochloric acid. The relations between the effects of the position and nature of the substituting groups were, in most cases, about the same with both acid and alkali. A methyl group in the ortho position retarded the action to a very marked degree. An amido group in the para position reduces the velocity of the reaction to less than one-fourth of that of benzamide. In the case of the amides containing the nitro group, or the halogens in the meta or para positions, the results with barium hydroxide were quite different from those obtained with hydrochloric acid. The amides containing the halogens were hydrolyzed two or three times as fast as benzamide, while the nitro group increased the speed of the reaction five and a half times when in the meta position, and six and a half times when in the para position. In the hydrolysis with alkali, the oxybenzamides gave quite abnormal results, the retarding effect being much greater than might have been expected from the experiments in acid solution. This was probably due to the fact that a part of the alkali reacted with the acid hydroxyl and, consequently, did not take part in the hydrolysis. Only about one-half of the theoretical quantity of ammonia could be obtained from *o*-nitrobenzamide, even when it was boiled with strong sodium hydroxide for a number of hours. A red substance was formed as the result of the reaction, which will be investigated further. The derivatives of benzamide which have been studied in this and the previous investigations are those in which the following groups are in the ortho position to the $CONH_2$ group: Cl, Br, I, OH, OCH_3, OC_2H_5, OC_6H_5, NO_2, NH_2, $N(CH_3)_2$, and CH_3; those in which the following groups are in the meta position: Br, I, NO_2, NH_2, CH_3, and OH; and those in which the following groups are in the para position: Cl, Br, I, NO_2, CH_3, NH_2, OCH_3, and OC_2H_5.

On the Molecular Rearrangement of Disubstituted Thioncarbamic Esters: Phenylimidothiocarbonic Acid Derivatives and Thiosemicarbazidic Esters. By Henry L. Wheeler and Guy K. Dustin. *Am. Chem. J.*, **24**, 424–444.—In previous papers it has been shown that monosubstituted thioncarbamic esters, XNH.CS.OR, react with alkyl iodides and give thiol derivatives, XNH.CO.SR. In order to determine whether the rearrangement was dependent on the presence of hydrogen, the disubstituted derivatives were studied, with the result that it was found that in this case a similar reaction took place. In order to determine the extent of the rearrangement, the compounds were

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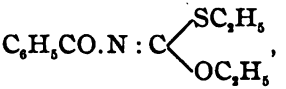
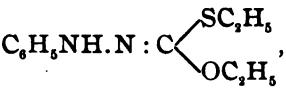
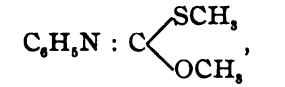
heated with mercuric oxide in alcoholic solution : the disubstituted thion derivatives were readily desulphurized, whereas the corresponding thiol derivatives were unaffected. As the study of the action of reagents upon acylimidothiocarbonic esters, *e. g.*,



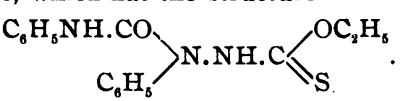
and upon anilinoimidothiocarbonic diethyl ester,



had shown that these substances were very reactive, analogous compounds containing the phenylimido group, *e. g.*,



were prepared and studied. These compounds are unreactive with both acyl chlorides and with organic bases, and show a wide departure in their properties from most compounds which contain the imidoester grouping. When, however, the above compound was heated with benzoyl chloride, methyl chloride was slowly given off and a compound of the structure $C_6H_5.C_6H_5CO : N.CO.SCH_3$ was formed. Acetyl chloride reacted with the silver salt of methyl thioncarbanilate in the cold : as a result silver chloride and an acetyl derivative, $CH_3CO.C_6H_5 : N.CS.OCH_3$, were formed. With the object of obtaining a new type of thiocarbamic esters, the behavior of acetyl and benzoylsulphocyanides with ethylphenylthiocarbazinates was investigated. It was found that the thion and thiol esters do not behave alike in this reaction. When acetyl- or benzoylsulphocyanide was mixed with ethyl phenylthioncarbazinate, hydrogen sulphide was evolved, and a very unstable compound was formed. When the corresponding thiol derivative, however, was used, no hydrogen sulphide was evolved and the compounds united directly to form an addition-product. Phenylthioncarbazinic ester forms an addition-product with phenylisocyanate, which has the structure



That the addition takes place to the nitrogen to which the phenyl group is attached, and that the grouping $-NHCS.OC_2H_5$ is present was shown by the behavior of the compounds with alkali and alkyl halides. With methyl iodide and sodium methylate, diphenylurea-imidothiolmethylethyl carbonate was formed. Under

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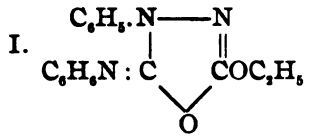
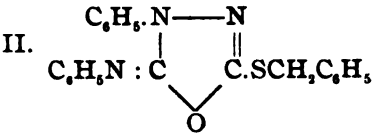
the same conditions ethyl iodide gave an analogous compound and a ring-formed compound, which probably has the structure of formula I:





With benzyl chloride but one compound was formed, and this, from the work on its structure as far as it has been carried, appears to have the structure represented by formula II. A study of the action of ethyl chlorcarbonate on some thion and thiol salts of carbonic and carbamic acids showed that no two of these salts behave alike, and that the reaction is very complicated. The preparation and properties of a large number of compounds are fully described.

The Detection of Methyl Alcohol in Mixtures. By S. P. Mulliken and Heyward Scudder. *Am. Chem. J.*, **24**, 444–452.—In a recent article by Jandrier it is stated that the test for methyl alcohol proposed by the authors (*this Rev.*, **5**, 68), based on the oxidation of the alcohol to formic aldehyde, followed by condensation of the latter to a colored derivative of resorcin, is unreliable, because it is also given by acrolein and is interfered with by the presence of furfurol. To remedy these defects Jandrier recommended the use of gallic acid in place of resorcin as the reagent for formic aldehyde. A careful examination by the authors of this modification of their test proved that its use is entirely inadmissible, notwithstanding the fact that gallic acid is a better reagent for formic aldehyde than is resorcin. Experiments showed that a great many compounds besides methyl alcohol gave traces of formic aldehyde when oxidized by means of hot copper oxide. It was impossible to distinguish these compounds from methyl alcohol and its simple derivatives when gallic acid was used, but that this could be done when resorcin was used, as it is a less sensitive reagent for the aldehyde. Detailed directions are given for carrying out the test when the alcohol is mixed with other substances.

On Some Derivatives of α-Nitro-β-dinitropropionic Aldehyde. By Joseph Torrey, Jr., and Otis Fisher Black. *Am. Chem. J.*, **24**, 452–465.—The authors have carefully studied the orange-red potassium salt obtained by Hill and Sanger (*Ber. d. chem. Ges.*, **15**, 1906) by the action of potassium nitrite on mucobromic acid, and have come to the conclusion that the substance is the dipotassium salt of α-nitro-β-dinitropropionic aldehyde. This conclusion was reached as the result of the study of the action of aniline on the compound, and from its conversion into

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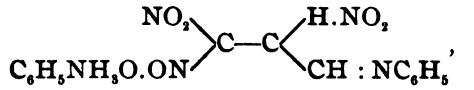
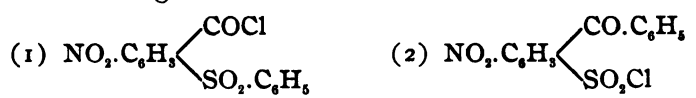
nitromalonic aldehyde. The compounds described are of unusual interest, as they do not closely resemble other nitro compounds in the fatty series. They are unusually stable, and the free nitro compounds can be readily obtained from their salts by acidification. When the orange-red salt mentioned above was treated with aniline acetate, it was converted into the aniline salt of α-nitro-β-dinitropropionic anil,



which decomposed at 84°–86°. This salt was decomposed by potassium hydroxide, and the dipotassium salt of the anil was formed, from which the free anil, $CH(NO_2)_2.CH(NO_2).CH : NC_6H_5$, decomposing at 90°, was obtained by precipitation with strong acids. By boiling the anil with alcoholic potash the phenylimide group was replaced by oxygen, and the original dipotassium salt of α-nitro-β-dinitropropionic aldehyde was obtained. This compound was converted by heating with water or alcohol into potassium nitromalonic aldehyde. The reaction which takes place when the dipotassium salt is treated with three molecules of aniline and an excess of hydrochloric acid is additional proof of the structure here put forward. Under these conditions there is produced, quantitatively, one molecule of nitromalonic aldehyde anil and two molecules of benzene diazonium chloride, which are formed from the aniline and the two nitro groups eliminated from the trinitropropionic aldehyde. Methylamine and *p*-toluidine were found to react like aniline with the nitroaldehyde, and a number of the resulting compounds are described.

On Paranitroorthotolylphenylsulphone and Some of Its Derivatives. By R. S. Norris. *Am. Chem. J.*, **24**, 469–491.—It has been shown by Hollis (*this Rev.*, **6**, 96) that, when the chloride of *p*-nitro-*o*-sulphobenzoic acid is treated with benzene and aluminum chloride, but one of the chlorine atoms is replaced by a phenyl group. As the product of the reaction is readily converted into an acid by heating with water, it must have one of the two following formulæ :



The work described in the present paper was undertaken to determine which of these formulæ is correct. A substance of the structure represented by formula 1, was prepared by a synthesis which left no doubt as to its constitution, and was found not to be identical with the compound described by Hollis, which must, therefore, have the structure given in formula 2. *p*-Ni-

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tro-*o*-toluenesulphone chloride (m. p. 44°) was converted by means of benzene and aluminum chloride into the corresponding sulphone (m. p. 158°) which, in turn, was oxidized to *p*-nitro-*o*-phenylsulphonebenzoic acid, $C_6H_3(NO_2)4,(SO_2.C_6H_5)2,(COOH)1$. This acid does not resemble the acid obtained from the chloride made by Hollis. It is difficultly soluble in water, melts at 196°, and forms well-characterized barium and calcium salts, which have one molecule and six and one-half molecules of water, respectively. This acid was converted into its chloride, which must have the structure given in formula 1 above. The chloride melted at 109°, whereas the chloride obtained by Hollis melted at 177° ; the latter must, therefore, have the structure of formula 2. As additional evidence, an attempt was made to condense *p*-nitro-*o*-cyanbenzenesulphone chloride with benzene, with the intention of saponifying the resulting nitrile, which would thus give, by a different synthesis, *p*-nitro-*o*-phenylsulphonebenzoic acid. It was found, however, that the presence of the cyan group prevented the condensation by means of the Friedel and Crafts reaction. In connection with the work the following-named substances were prepared : a sulphonic acid from *p*-nitro-*o*-tolylphenylsulphone, the barium salt of which was analyzed ; *p*-amido-*o*-tolylphenylsulphone (m. p. 156°) ; and *p*-nitro-*o*-phenylsulphonebenzamide (m. p. 191°–192°).

Derivatives of Phenyl Ether. By A. N. Cook and H. W. Hillyer. *Am. Chem. J.*, **24**, 525–529.—2-Nitro-4′-methylphenyl ether, $NO_2.C_6H_4.O.C_6H_4.CH_3$, prepared from *o*-bromnitrobenzene and potassium cresolate, melts at 49°, boils at 220° at 25 mm. pressure, and is converted into 2-nitrophenylether-4′-carbonic acid, $NO_2.C_6H_4.O.C_6H_4.COOH$, when oxidized by chromic acid. This acid melts at 182°–183° and gives insoluble salts with most of the heavy metals. 2-Amino-4′-methylphenyl ether is unstable, but forms a hydrochloride, which melts at 220°, and a chlorplatinate, which contains one and one-half molecules of water and melts at 150°.

A Further Investigation of the Symmetrical Chloride of Paranitroorthosulphobenzoic Acid. By W. E. Henderson. *Am. Chem. J.*, **25**, 1–26.—By a slight modification of the method of Remsen and Gray (*this Rev.*, **3**, 155) the symmetrical chloride of *p*-nitro-*o*-sulphobenzoic acid (m. p. 98°) was obtained in pure condition, with an average yield of 40 per cent. of the theoretical quantity. The compound forms large monoclinic crystals, which were measured. When the chloride was treated with benzene and aluminum chloride, but one chlorine atom was replaced by the phenyl group. The resulting compound—*p*-nitro-*o*-benzoylbenzenesulphone chloride (m. p. 177°)—was identical with the product obtained from the unsymmetrical chloride under the same circumstances. The chloride was converted into an acid, of

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which the barium salt was prepared. This salt has been shown by Hollis (*this Rev.*, **6**, 96) to unite with different quantities of water of crystallization, under varying conditions. It is shown by the author that if the solution of the salt is boiled with bone-black and all coloring-matter is removed, but one hydrate, which contains 7 molecules of water, can be formed. With methyl and ethyl alcohols the chloride yielded the acid esters of *p*-nitro-*o*-sulphobenzoic acid. With ethyl alcohol the unsymmetrical chloride was converted into the chloride of the acid ethyl ester of the sulphobenzoic acid. With phenols the symmetrical chloride gave two series of derivatives. With monohydroxyphenols both esters and sulphophthaleïns were formed, the former being produced in larger quantities. The esters prepared from phenol, *o*-cresol, and *p*-cresol melted at 119°, 90°, and 117°, respectively. With polyhydroxyphenols no esters were obtained, but compounds of the unsymmetrical type, usually containing more than two phenol residues, were formed. When the chloride and aniline were brought together in chloroform solution, the symmetrical anilide (m. p. 222°) and the anil (m. p. 183°) were formed. In ethereal solution, in the presence of potassium carbonate, but one anilido group was introduced. The resulting acid was converted into its barium salt, which was analyzed. By the action of phosphorus oxychloride the anilide was converted, by loss of one molecule of water, into a dianil (m. p. 208°). This dianil is changed by glacial acetic acid into an unsymmetrical anilide, which does not melt or decompose at 340°. When heated with hydrochloric acid, aniline was split off and the anil was formed.

The Action of Sulphuric Acid on Phenetol. By William B. Schober and Henry L. Bowers. *Am. Chem. J.*, **25**, 69–77.—Phenetol was heated with concentrated sulphuric acid under varying conditions of concentration, time of heating, and temperature. *p*-Phenetolsulphonic acid was formed in every case when the reaction took place at temperatures varying from 21° to 90°. The amount of the acid which was isolated, decreased the longer the substances were heated at 90°. The best yield was obtained when equal weights of sulphuric acid and phenetol were heated at 90° for thirty minutes. From 15 grams of phenetol 16.5 grams of the *p*-sulphonamide were obtained. *m*-Phenetolsulphonic acid was formed in small quantities in most of the experiments. A minute quantity of the disulphonic acid was produced when phenetol was heated at 85°, for thirty minutes with fuming sulphonic acid.

On Triphenylchlormethane. By James F. Norris and Warren W. Sanders. *Am. Chem. J.*, **25**, 54–62.—When a carbon disulphide solution of carbon tetrachloride and benzene in the proportions of one molecule of the former to four molecules of the latter was treated with aluminum chloride, care being taken

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to prevent a rise in temperature, a reaction took place, which was complete in twenty-four hours. As the result, a well-crystallized compound of the formula $Al_2Cl_6.2(C_6H_5)_3CCl$ was formed. This compound was decomposed by water, and when the temperature was kept at 0°, 97 per cent. of the theoretical yield, calculated from the carbon tetrachloride used, was obtained. In an attempt to make tetraphenylmethane, an ethereal solution of triphenylchlormethane and brombenzene was treated with sodium. Among the products of the reaction was a substance which resembled closely triphenylmethyl peroxide, which has recently been described by Gomberg (*this Rev.*, 7, 6). The authors propose to investigate the action of sodium on triphenylchlormethane, as preliminary experiments indicated that under certain circumstances these substances react, notwithstanding the fact that previous observers have found that they do not react.

On Triphenylchlormethane. By M. Gomberg. *J. Am. Chem. Soc.*, **23**, 109–110.—The author calls attention to the fact that his work on triphenylchlormethane, which has been recently published (*this Rev.*, 7, 6), was probably completed before the work mentioned in the preceding review was begun. As stated above, Norris and Sanders found that sodium reacted with triphenylchlormethane. The author, in an earlier investigation, found that no reaction took place when these substances were brought together in benzene solution, and now expresses a regret that Norris and Sanders propose to investigate the subject farther, as he is continuing his investigations on triphenylmethyl.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Composition and Analysis of London Purple. By J. K. Haywood. *J. Am. Chem. Soc.*, **22**, 800–810.—Procedures are described for the determination of moisture, total arsenious and arsenic acids, total calcium, and also for soluble arsenious acid and soluble calcium, and "other inorganic matters." The author concludes that the arsenic and arsenious acids and calcium are usually combined as normal calcium arsenite and arsenate in the London purple, but that compounds corresponding to the symbols $CaHAsO_3$ and $Ca_2As_2O_5$ are occasionally present.

Kilgore's Modification of the Volumetric Method of Estimating Phosphoric Acid. By C. B. Williams. *J. Am. Chem. Soc.*, **23**, 8–12.—The author finds the Kilgore procedure highly satisfactory, on the side of both rapidity and accuracy. The procedure is described in detail.

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A Method of Preparing Normal, Seminormal, Decinormal, Etc., Sulphuric Acid of Exact Strength. By RICHARD K. MEADE. *J. Am. Chem. Soc.*, **23**, 12–15.—Pure, crystallized copper sulphate is dissolved in water, and the copper deposited upon a cathode of copper foil. The resulting solution of sulphuric acid, which was found to be free from copper after being subjected to a current of 1.5 amperes for eight hours, is diluted to the required volume.

Soluble Arsenious Oxide in Paris Green. Preliminary Report. By S. AVERY AND H. T. BEANS. *J. Am. Chem. Soc.*, **23**, 111–117.—The authors find that the term "soluble arsenious oxide" as applied to Paris green is of doubtful significance, since the material, especially in a finely divided condition, undergoes hydrolysis when suspended in water, as a result of which arsenious acid passes into aqueous solution, the amount increasing to a maximum with the time of exposure. This point is assumed to represent a state of equilibrium, but it is only reached after weeks of standing. Carbon dioxide is found to greatly promote the decomposition of the Paris green, and this constituent of the atmosphere may very well, under certain atmospheric conditions, cause a fair sample of the insecticide to exhibit the properties of a sample containing much more than the four per cent. of "soluble arsenious acid," which is fixed upon as a maximum allowable quantity by Hilgard and others. Compare *this Rev.*, **6**, 168, and **7**, 34.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O CROSBY, REVIEWER.

The Analyses of Italian Volcanic Rocks. By H. S. WASHINGTON. *Am. J. Sci.*, **159**, 44–54.—Analyses are given of the following types of rocks: Ciminite, from Monte Cimino, Viterbo; Mica Trachyte (selagite), from Monte Catini, Tuscany; Andesite, Radicofani, Tuscany; Leucitite, from Capodi Bove, Alban Hills. A discussion is made of the analyses, the mineralogical composition of the rocks, and their classification in accordance therewith.

Occurrence of Native Lead with Copper and Other Minerals at Franklin Furnace, N. J. By W. M. FOOTE. *Am. J. Sci.*, **156**, 187–188.—Small irregular masses of lead, 1 to 2 mm. in diameter, associated intimately with native copper and a variety of minerals—among them axinite, garnet, willemite, and phlogopite—have been found on a few specimens taken from the 800-foot level of the Parker shaft on North Mine Hill. The rarity of native lead and its associations at Franklin make the discovery interesting.

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Occurrence of Sperrylite in North Carolina. By W. E. Hidden. *Am. J. Sci.*, **156**, 380–381.—The mineral sperrylite—a diarsenide of platinum—is described from Macon County, N. C., where it was discovered in the sands of Cowee Creek, associated with a little gold and the minerals monazite, zircon, and menaccanite. The sperrylite consisted of a few very minute, nugget-like particles and crystals, the latter showing the combination of the cube and octahedron.

Thomsonite, Mesolite, and Chabazite from Golden, Colorado. By Horace B. Patton. *Geol. Soc. Am.*, **17**, 461–474; plates, 43–49.—The paper gives a detailed description, supplemented by excellent plates, of the occurrence and habits of the above-named zeolites, found in a scoriaceous band of the basalt flow which caps what is known as Table Mountain, near Golden.

Reconnaissance of the Gold Fields of Southern Alaska, with Some Notes on General Geology. By George F. Becker. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 1–86.—The active or recently active, Alaskan volcanoes are described at some length. The most modern methods are applied in the distinction of the feldspars in the Alaskan rocks; and the petrographic descriptions are accompanied by numerous chemical analyses, chiefly by Hillebrand, including the Alaska-Treadwell syenite, Karluk diorite, pyroclastic diorite, gabbro, andesite, dacite, and other lavas.

Geology of the Yukon Gold District, Alaska. By Josiah Edward Spurr. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 87–392.—This long paper, with an historical introduction by Harold B. Goodrich, is the most complete and elaborate account of the geology, both theoretic and economic, of the famous Klondike region, which has yet appeared. The geological formations, both sedimentary and eruptive, are described in great detail, but the descriptions are not accompanied by analyses. Following this section is an important chapter on the movements in the earth's crust, after which the modes of occurrence of the valuable metals in solid rocks are described and discussed, with some assays and other chemical notes. The interest of this chapter culminates in the section on the genesis of auriferous quartz veins, in which the author accepts the view of a perfect gradation between veins and igneous rocks, recognizing pegmatite as a true intermediate type, the product of the equal cooperation of heat and water. The various theories of rock differentiation are discussed; the source of the gold is found in the igneous rocks, in which, however, because of the viscosity of the magmas, it fails of concentration; but in passing from igneous through aqueo-igneous to aqueous conditions the magmas become progressively more fluid; and the auriferous quartz vein is thus shown to be the normal final product, or the end term of the lithologic series. The important chap-

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ter on the placer deposits discusses the origin of the placer gold, only to accept its mechanical derivation from the rock formations and to reject the hypothesis that it is due in any appreciable degree to chemical deposition in the gravels. The brief account of coal in the neighborhood of the gold belt contains two partial analyses by H. N. Stokes, which show the coals to be hard lignites.

Some Coal Fields of Puget Sound. By Bailey Willis. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 393–436.—This paper is essentially stratigraphic and structural, with no details as to the composition or chemical relations of either the coals or the associated rocks. It is stated in the introduction, however, that the coals vary from lignites containing: moisture 8 to 12, volatile hydrocarbons 35 to 45, and fixed carbon 30 to 45 per cent., to bituminous lignites or steam coals, in which the moisture is reduced to 5 per cent. or less, and the fixed carbon ranges from 40 to 50 per cent., or to bituminous coking coals containing moisture 1 to 3, volatile hydrocarbons 25 to 35, fixed carbon 50 to 60 per cent. The ash of these coals is frequently as much as 10 per cent.

Geology and Mineral Resources of the Judith Mountains of Montana. By Walter Harvey Weed and Louis Valentine Pirsson. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 437–616. —The elaborate stratigraphic and structural sections making up the main part of this paper are followed by a chapter by Pirsson on the igneous rocks, which embrace only a few acid types of simple mineral composition, belonging to the granite, syenite, and phonolite families. For the tinguaites of the phonolite family eight analyses are quoted, from which the mineral composition is deduced. The chapter on dynamic and structural geology discusses the forms and origin of the laccolites, in which the igneous rocks chiefly occur, and the concluding chapter on the mineral resources notes that the ores are chiefly gold, original tellurides now altered by oxidation, with fluorite as a prominent gangue mineral, and with a general resemblance to the Cripple Creek deposits. The paper closes with four analyses of the Judith Mountain Coals, which are shown to belong to the splint and cannel varieties and to be of excellent quality.

A Geological Sketch of San Clemente Island. By William Sidney Tangier Smith. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 2*, 459–496.—San Clemente is built up almost entirely of lava flows, with intercalated volcanic breccias and ash deposits. The prevailing volcanic is normal pyroxene-andesite, ranging in chemical composition from basic to acid. But the youngest lavas include dacite and rhyolite, containing, respectively, 67 and 70 per cent. of silica. Four analyses, two by the author and two by

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W. O. Smith, give the composition of the rhyolite and dacite, and less completely of two types of the andesite, one with and the other without iddingsite. The analyses are not discussed.

The Mining Districts of the Idaho Basin and the Boise Ridge, Idaho. By WALDEMAR LINDGREN. *U. S. Geol. Survey, Ann. Rep.*, 18, *Part 3*, 617–719.—The ores in which gold values predominate are only in part free milling; and they all occur in granite or associated dikes. The granite country rock is extensively altered in the vicinity of the veins, and two analyses by George Steiger, of fresh and altered material, show the degree and character of the alteration, in which atmospheric agencies have played no part. From the analyses the mineral compositions are deduced, and a comparison of these is very instructive, as showing how comparatively slight chemical changes may correspond to a mineralogical revolution, the complete replacement of the original biotite and feldspars by sericite being the most striking feature of the change. The detailed descriptive chapters embody some assays of the ores, and data with regard to the fineness of the gold are given for each district.

Preliminary Report on the Mining Industries of the Telluride Quadrangle, Colorado. By CHESTER WELLS PURINGTON. *U. S. Geol. Survey, Ann. Rep.*, 18, *Part 3*, 745–848.—The chemistry of this paper begins with the chapter on the ore, in which a list of the ore and gangue minerals and their distribution is followed by descriptions with notes upon the composition and origin of the species. The distribution of the ores and minerals in the veins, the manner of deposition, the influence of the country rock on the values in the veins, the origin of the ore, the age of the deposits, surface alteration, water-level, and the auriferous impregnation of Silver Mountains, are important sections for the student of ore deposits and chemical geology. They embrace several miscellaneous analyses.

The Slate Belt of Eastern New York and Western Vermont. By T. NELSON DALE. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 153–307.—This is a very complete and well illustrated paper on one of the most important slate districts of North America. Although it is, necessarily, in the main, a structural and economic study, the fine series of exhaustive analyses, chiefly by W. F. Hillebrand, make this a very notable contribution to the chemistry of the roofing slates. The analyses, some twenty in number, and consisting, each, of from twenty to twenty-five determinations, include especially the "sea-green," "unfading green," purple and variegated, red, bright green, and black slates, and the green spots in the red slates. In addition, nine analyses are quoted for the slates of other regions. The chemical constituents of the roofing slates are shown to be referable to about ten dis-

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tinct minerals. The paper closes with an appendix by Hillebrand, discussing especially the fading of some of the green slates, which he attributes mainly to the solution of a complex carbonate of calcium, magnesium, manganese, and iron. This carbonate is shown to be the most variable constituent of the slates, and the elimination of this, together with the apatite and pyrite, from the analyses makes them much more accordant. The green spots in the slates are shown to be richer in this complex carbonate, silica or quartz, pyrite, rutile, and tourmaline than the surrounding slates, and poorer in hematite, and to be unquestionably due primarily, as hitherto supposed, to the reducing action of decaying organic matter upon the ferric oxide.

The Coos Bay Coal Field, Oregon. By J. S. Diller. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 309–376.—This is almost exclusively a structural study; but the author gives us, without discussion, thirty-two analyses of the coals, chiefly by George Steiger; and the supplementary chapters by William C. Day on the coal and pitch coal of the Newport Mine gives additional analytical results, from which the author concludes that the pitch coal has been formed after the manner of asphalts and that it is a true asphalt.

The Titaniferous Iron Ores of the Adirondacks. By James Furman Kemp. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 377–422.—Upon the study embodied in this paper was based the author's review of the titaniferous magnetites of the world, previously noticed in this Journal. We here find the New York ores more fully considered, with detailed descriptions of the ore formations and mines, and maps and other illustrations; but the analyses, nearly forty in number, and the chemical discussion are essentially the same.

Geology of the McAlester-Lehigh Coal Field, Indian Territory. By Joseph A. Taff. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 423–456.—The carboniferous strata of this district form a series of rather deep synclinal folds or basins and the two productive coal beds occur in the McAlester shale, which has a thickness of 2,000 feet. The Hartshorne coal is at the base of the shale and the McAlester coal is 700 feet below the top of the shale, 1300 feet of coal separating the two seams, each of which averages about four feet in thickness. The coals of this field are all highly bituminous, the volatile matter being in no instance less than 37 per cent., and the fixed carbon averaging about 52 per cent. The moisture is low, averaging about 2 per cent., and the sulphur and ash are rarely excessive. Five proximate analyses by W. F. Hillebrand are given.

Iron Ores. By John Birkinbine. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 23–63.—This annual statistical account, or sum-

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mary of exploitation and production, of the iron ores of the United States for 1897 embodies a few new analyses. These include one analysis of the shipping ore of the Tilly Foster Mine, one analysis of the raw ore of the Cornwall Mine, nearly two hundred analyses of the Lake Superior ores from the Gogebic, Marquette, Menominee, Mesabi, and Vermilion ranges, and three analyses of the Red Mountain ores of Alabama.

Manganese Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 91–125.—This is a general account for 1897 of the manganese ores of the world. The analyses are a very secondary feature; but five analyses are given of the ore mined near Vesuvius, Virginia, one analysis of a French ore, two of Russian ore, one of a Spanish ore, and four of Japanese ores.

Asphaltum. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 187–204.—This general account of the domestic production and imports of asphaltum for 1897 contains two analyses of the asphaltum from the mines of Santa Barbara and Ventura Counties, California.

Stone. By WILLIAM C. DAY. *U. S. Geol. Survey, Ann Rep.*, 19, *Part 6*, 205–309.—This somewhat elaborate account of the production of building and decorative stones in the United States for 1897 fairly bristles with the results of tests and analyses. Among the stones of which numerous analyses are given are granite, trap, marble, slate, sandstone, limestones, and lime, all of these being represented by specimens from a large number of localities.

The Kaolins and Fire Clays of Europe. By HEINRICH RIES. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 377–467.—This paper is crowded with analyses, mainly quoted but partly new, and in part of American materials for comparison with the foreign.

The Clay-Working Industry of the United States in 1897. By HEINRICH RIES. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 469–489.—This brief review of a great industry is chiefly chemical, embodying more than one hundred and fifty analyses, a large proportion of which had not been previously published.

Portland Cement. By SPENCER B. NEWBERRY. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 487–494.—The only original chemical contribution in this paper is an analysis of a nearly pure calcareous marl from Syracuse, Indiana, which it is proposed to use for cement manufacture on a large scale.

Abrasive Materials. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 515–533.—The descriptions of new occurrences and the statistics of production of the various abrasives are supplemented, in the case of pumice, by five analyses of pumice from Utah and Nebraska.

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Phosphate Rock. By DAVID T. DAY. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 535–556.—Five new analyses by L. P. Brown of the phosphate rock of Tennessee are given, with one analysis for comparison of the unaltered limestone from which the phosphate rock is derived by differential erosion—solution of the calcium carbonate.

Memorandum on the Mineral Resources of the Philippine Islands. By GEORGE F. BECKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 687–693.—This paper consists of very brief notes on coal, gold, copper, etc. ; and for the coal, which is supposed to be all of Tertiary age, and is described as a highly carbonized lignite, a single analysis is given, showing : water, 13.52 ; volatile matter, 37.46 ; fixed carbon, 44.46 ; ash, 4.56 ; total, 100.00 per cent.

The Gold and Silver Veins of Silver City, De Lamar and Other Mining Districts in Idaho. By WALDEMAR LINDGREN. *U. S. Geol. Survey, Ann. Rep.*, 20, *Part 3*, 75–256.—This economic monograph supplements that in the Eighteenth Annual Report on Boise Ridge and Idaho Basin, the chief igneous rocks, besides the Columbia volcanics, are the granites, of which four complete analyses are given. The analyses are also recalculated to show the molecular proportions of the constituents and the probable mineralogical composition. The quartz (28 to 29 per cent.) is regarded as too low for a normal granite, and the ratio of the soda-lime to the potash feldspar (3 : 1) too high. Accordingly, while retaining "granite" as a general designation, the author assigns the rock a position between the granodiorites and the quartz-monzonites. Passing to the mineral deposits, the filling of the fissures by ascending thermal solutions is regarded as proved by compact siliceous spring deposits with vegetable remains and containing gold and silver ; and especially by the alteration of the wall rock. Impregnation and replacement of the wall have not, in general, however, yielded much ore of working grade. Many different types of veins are recognized in the district, and the mineralogical and other characters of each are indicated. The detailed descriptions of the mines include many assays and analyses of the ores and associated gangues and country-rocks. Of special interest among the gangue materials is orthoclase, which, although of rare occurrence in metalliferous veins, is a prominent feature of some of the veins at Silver City. The analysis shows it to be a very pure potash feldspar. It belongs to the variety adularia ; but to distinguish orthoclase in the gangue from that in the wall-rock the author proposes for the former Breithaupt's old name *valencianite*. The alteration of the wall-rocks—granite, basalt, rhyolite, etc.—by hydrothermal action is discussed at length, with numerous complete analyses.

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The chemical work embodied in this monograph has been done chiefly by Messrs. Hillebrand, Stokes, and Steiger.

Geology of the Little Rock Mountains, Montana, with Notes on the Mineral Deposits of the Neikart, Barker, Yogo, and Other Districts. By WALTER HARVEY WEED. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 3*, 257–461.—This is another elaborate economic monograph; but unlike the preceding paper, it embodies but little chemical work; and the only thing demanding special mention is an analysis of a complex carbonate, which is probably a mixture of rhodocrosite and ankerite. It occurs abundantly as a part of the gangue of the Neikart veins.

Petrography of the Igneous Rocks of the Little Belt Mountains, Montana. By L. V. PIRSSON. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 3*, 463–581.—This monograph supplements the preceding, and includes the chemical analyses and discussions properly belonging to a complex petrographic study. The numerous analyses, partly original, by Hillebrand, the author, and others, and partly quoted for comparison, embrace syenites, monzonites, diorites, granite-syenite-aplite, granite-porphyry, syenite-porphyry, diorite-porphyry, diorite-syenite-porphyry, rhyolite, minettes, analcite-basalts, and lamprophyres. These rocks occur chiefly in the form of laccoliths, and an attempt is made, by generalizing the chemical and mineralogical composition of the six principal laccoliths, to throw some light upon the genetic or magnetic relations of the rocks. Individually, the laccoliths are not differentiated, which is accounted for by the acidity and viscosity of the magma at the time of its intrusion. Chemical composition is found to be a much more important factor than depth in determining the texture or grain of the rocks. A similar study of the stocks and massives shows, in one instance (Yogo Peak), a marked radial differentiation, so that we pass outward from a center of acid syenite through intermediate types to a periphery of shonkinite, a very basic rock. The nature and cause of this gradation are discussed; and the aplitic dikelets intersecting the basic exterior are shown to find a ready explanation in the injection of shrinkage cracks by the magma residuum.

Iron Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 27–59.—This general statistical account of the exploitation and production of iron ores in the United States in 1898 embodies about one hundred and fifty complete cargo analyses of the Lake Superior ores, including the Gogebic, Marquette, Menominee, Mesabi, and Vermilion ranges. The analyses of the ores in their natural state gave percentage results which are summarized as to metallic iron and water as follows:

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Range.	Iron.	Moisture.
Marquette.....	66.8 to 39.26	0.43 to 16.68
Menominee	60.62 " 39.46	2.51 " 11.00
Gogebic.....	60.56 " 44.83	8.24 " 14.34
Vermilion	66.67 " 55.06	1.04 " 8.38
Mesabi.....	60.77 " 51.50	6.94 " 12.54

This summary shows that comparatively few Lake Superior ores contain in their natural state 60 per cent. or more of metallic iron, and that the richer ores are practically confined to the Marquette and Vermilion ranges, where some ores approach 67 per cent. of iron. But the ores are marketed upon analyses made after drying at 212° F., and comparatively few are shipped which show on this basis less than 60 per cent. of metal. The leaner ores indicated by the minima of the table have some special value, either because of very low phosphorus content, the manganese they carry, or, because being highly siliceous and cheaply mined, they form desirable mixtures with low silica ores. The concluding section, on the Montana iron ores, contains several analyses of the ores of prospective iron mines on Judith and Fox mountains.

Manganese Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 125–158.—This paper, like the preceding, is a summary of discovery, exploitation, and production for 1898; but three analyses are given of Lake Superior manganiferous iron ores, showing from 4.50 to 7.40 per cent. of manganese; eight analyses of manganese ores from Santiago, Cuba; five analyses of manganese ores from Chili; and the paper concludes with a summary of the mineralogical and chemical characteristics of manganese ores.

Asphaltum and Bituminous Rock. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 251–268.—This annual statistical summary of the exploitation and production of asphaltum for 1898 contains the results of an investigation by William C. Day, of a new solid asphalt from Utah, known as nigrite on account of its intensely black color. The nigrite forms a fissure vein and is said to bear no relation, geologically or otherwise, to the small deposits of ozocerite found in the vicinity. In its mode of occurrence it resembles gilsonite and wurtzilite, but has none of the vulcanite qualities of the latter nor the pitchy, easy fluxing character of the former. Three analyses are given, showing the proportions of volatile matter, fixed carbon, and ash, and also of carbon, hydrogen, nitrogen, and sulphur, and the solubilities in various solvents. Nigrite differs from all other asphalts in grinding to a shining black instead of a dull brown powder. Its solubility is low and it cannot be entirely melted. The volatile matter is high, but less volatile than for ordinary asphalts. The theory that nigrite was formed by distillation,

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that is, by the passage of steam through an oil, thus depriving it of the most volatile constituents, while subsequent heating of the residue converted it into the nigrite, as found, is fully confirmed by experiments.

Stone. By William C. Day. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 269–464.—This is the annual statistical summary of the exploitation and production of building and decorative stones, for 1898; but much more attention is given than usual to the chemical composition of the stones. The numerous analyses are mainly quoted, but a few are new. They include Hillebrand's very elaborate analyses of the slates of Eastern New York and Western Vermont, and nine analyses of the slate of other regions, and then follows, in the alphabetical order of the states, a résumé of pretty much all that has been done in the way of analyses and chemical and physical tests of the stones of this country, constituting a storehouse of data, which should be widely known and used.

Fuller's Earth. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 741–743.—Accompanying the statistics of the production for 1898 are analyses of fuller's earth from Ocala, Florida, and Valentine, Nebraska.

Mineral Resources of Porto Rico. By Robert T. Hill and H. B. C. Nitze. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 771–787.—The descriptions of the economic products are supplemented by analyses, in part new, of mineral waters, iron ore, and copper ore.

Geology and Mining Industry of the Tintic District, Utah. By George Warren Tower, Jr., and George Otis Smith. *U. S. Geol. Survey, Ann. Rep.*, **19**, *Part 3*, 601–767.—This important and elaborate economic monograph of one of the oldest mining districts of the west, embodies analyses by H. N. Stokes and George Steiger of the principal sedimentary and igneous rocks of the region, including the Eureka and Godiva limestones, in which the ore bodies occur, and the Hamburg series of impure limestones and sandstones, all of carboniferous age, though resting directly upon the Robinson (Cambrian) quartzite, and including also rhyolites, quartz porphyry, andezite, and monzonite among the igneous rocks. The metamorphism and weathering of the rocks are briefly discussed; and the character of the ore-bearing solutions, the origin of the metals and gangue, and the secondary changes in the ores, are considered. In the descriptions of the ore deposits the most notable features are the mineralogical complexity, embracing about fifty species, and the analyses, chiefly by Hillebrand, of the truly remarkable series of copper arsenates, sulphates, etc., for which the Tintic district is famous.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 5.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

F. J. MOORE, REVIEWER.

The Iodometric Estimation of Arsenic Acid. BY F. A. GOOCH AND JULIA C. MORRIS. *Am. J. Sci.*, **160**, 151–157.—Solutions of arsenates are reduced by soluble iodides with separation of iodine. As the reaction is a reversible one, it is necessary, for analytical purposes, to eliminate the oxidizing effect of the liberated iodine. Gooch and Browning (*Am. J. Sci.*, **50**, 66) accomplished this by boiling off the iodine. The same result would be effected by changing the iodine to hydriodic acid by means of sodium thiosulphate. An attempt to base an analytical procedure upon this principle was made by Williamson (*J. Soc. Dyers and Colorists*, *1896*, 86–89). According to Williamson, the arsenic acid could be measured either by the amount of thiosulphate required to bleach the solution, or, after the reduction, the arsenious acid formed could be again oxidized by iodine. If the thiosulphate method is used the titration must be made in a strongly acid solution. This introduces an error on account of the tendency of the hydriodic acid to oxidation in the presence of strong acids, and also because the thiosulphate added is liable to be decomposed before it can react with the iodine. The authors find that when this method is used a correction of —0.003 gram must be applied to each determination of arsenic acid. If the arsenite is oxidized by iodine, the arbitrary correction necessary is reduced to 0.0015 gram. The authors consider both methods inferior to that of Gooch and Browning.

The Volumetric Estimation of Copper as the Oxalate with Separations from Cadmium, Arsenic, Tin, and Zinc. BY CHARLES A. PETERS. *Am. J. Sci.*, **160**, 359–367.—Copper may be completely precipitated as oxalate in solutions containing the

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above metals. The precipitated oxalate is then filtered off on asbestos and titrated with permanganate in the presence of sulphuric acid. The essentials for complete precipitation are a large excess of oxalic acid and the presence in the solution of a certain minimum amount of copper depending in each case upon the volume of the solution and the concentration of the oxalic acid. Thus in a solution containing 0.064 gram copper in 50 cc., the copper will be completely precipitated by a gram of oxalic acid. By adding oxalic acid to the point of saturation, the minimum amount of copper required for the same volume of solution is reduced to 0.012 gram.

The Sulphocyanides of Copper and Silver in Gravimetric Analysis. By R. G. Van Name. *Am. J. Sci.*, **160**, 451–457.—The literature contains conflicting statements concerning the practicability of determining copper by direct weighing of cuprous sulphocyanate. The author finds the method satisfactory. The copper solution is first reduced with ammonium bisulphite and then precipitated by ammonium sulphocyanate. The precipitate is filtered off on a Gooch crucible, and weighed after drying at 110°. Contrary to the statements of some writers, the precipitate does not retain water at this temperature. As the sulphocyanate of silver is soluble in an excess of ammonium sulphocyanate, this method cannot be used for the determination of silver, but as the precipitate is insoluble in an excess of silver nitrate it may well be made use of for standardizing sulphocyanate solutions for use in the Volhard method.

Method for Graphite in Pig Iron. By A. B. Harrison. *Proc. Eng. Soc. Western Pa.*, **16**, 117–118.—One gram of pig iron is dissolved in nitric acid of 1.13 specific gravity, and the solution is boiled till red fumes are no longer expelled. Two filters are accurately tared and the residue is filtered off, after diluting the solution, which is allowed to run through both filters. The filters are washed successively with nitric acid, water, ammonia, alcohol, and ether, and are dried and weighed. The filter containing the graphite is then ignited, and the weight of the ash is deducted from the difference between the final weights of the two filters.

Analysis of Chrome and Tungsten Steels. By A. G. McKenna. *Proc. Eng. Soc. Western Pa.*, **16**, 119–121.—A 5-gram sample is dissolved in an evolution flask in a mixture of 30 cc. strong hydrochloric acid and 30 cc. water. The gases evolved are passed through a cadmium chloride solution in which the sulphur is afterwards determined by titration with permanganate. The solution in the flask is evaporated to dryness, and the residue is dehydrated and treated with about 100 cc. water. The insoluble residue is filtered off, ignited, and weighed as tungstic oxide and

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silica. The contents of the crucible are then treated with hydrofluoric acid and the silica determined by loss. The filtrate is evaporated with nitric acid to expel the hydrochloric acid, then potassium chlorate is added and the precipitated manganese dioxide is filtered off on asbestos. Then it is dissolved in hydrochloric acid with the addition of a little potassium nitrite. After removal by the basic acetate method, of any iron this solution may contain, the manganese is precipitated by bromine water and weighed as Mn_3O_4. In the filtrate from the manganese, the chromium is determined by titration with ferrous sulphate and permanganate. For the determination of phosphorus another 5-gram sample is dissolved in hydrochloric acid, and, after the removal of the tungsten and silicon as before, the phosphorus is precipitated as ammonium phosphomolybdate. The author recommends the direct weighing of the "yellow precipitate." For the carbon determination a sample of 1.5 grams is dissolved in the double chloride of copper and potassium. After a half-hour hydrochloric acid is added, and when all the copper has gone into solution, the residue is filtered off and burnt in a current of oxygen, using a platinum tube. The carbon dioxide evolved is absorbed in a solution of barium hydroxide, and the amount of carbon is calculated from the weight of barium carbonate produced.

Some Rapid Work on Silicons. By DALTON PARMLEY. *Iron Trade Rev.*, **34**, No. 9.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

The Production of Alloys of Tungsten and of Molybdenum in the Electric Furnace. By CHARLES L. SARGENT. *J. Am. Chem. Soc.*, **22**, 783–791.—Alloys of tungsten and molybdenum with nickel, cobalt, and chromium were made by heating the dioxides of these metals in an electric furnace with carbon. The amount of carbon used exerted a greater influence in the purity of the metal than did variations in the strength of the current and the duration of its action. The product invariably contained traces of carbon and unreduced oxide. Tungsten did not form alloys with bismuth and manganese, while molybdenum alloyed with both of these metals, but would not alloy with copper, which combined readily with tungsten. Neither metal would alloy with tin.

Irregular Distribution of Sulphur in Pig-Iron. By RANDOLPH BOLLING. *J. Am. Chem. Soc.*, **22**, 798–799.—The sulphur was determined in drillings made at intervals of $1\frac{5}{8}$ inches in a cast bar 12x14 inches, and was found to vary from 0.023 per cent. at the bottom to 0.036 per cent. at the top.

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Alloys Made in the Electric Furnace. By Lewis P. Hamilton and Edgar F. Smith. *J. Am. Chem. Soc.*, **23**, 151–155.—Metallic masses, composed of mixtures of various elements, contaminated with iron, carbon, silicon, and "gangue" were obtained by heating the oxides with carbon and iron or copper in a special form of electric furnace. The properties of these metallic masses were not studied.

On the Behavior of Iodine and Bromine Towards Chlorine Heptoxide and Perchloric Acid. By Arthur Michael and Wallace T. Conn. *Am. Chem. J.*, **25**, 89–96.—The authors find no evidence for the statement of Kaemmerer that chlorine may be replaced in its oxygen acids by iodine or bromine. In the preparation of chlorine heptoxide they find that the danger of explosion may be decidedly reduced by keeping the retort containing the phosphorus pentoxide at a lower temperature than —10° (see *this Rev.*, **6**, 114), during the addition of perchloric acid, and for some hours afterward. Instead of heating the retort gradually to 85° in a water-bath, it is better to heat slowly, and after two hours to remove the heptoxide from the receiver, when about two-thirds of the amount formed has passed over; then to heat four hours longer at the same temperature, and finally at 85° to drive off the last traces of heptoxide. A very energetic reaction takes place when iodine and chlorine heptoxide are brought together. The product of the reaction is a white powder which fumes in the air. Heated to 100° in a vacuum, perchloric acid distils off and iodine pentoxide is left behind. The action of anhydrous perchloric acid on iodine is less energetic than that of chlorine heptoxide. The product of the reaction is a moist, pinkish, crystalline powder, which leaves a yellowish, crystalline substance when heated in a vacuum. This substance is extremely hygroscopic, and rapidly turns black on exposure to air, owing to the liberation of iodine. In contact with water it is immediately decomposed with liberation of iodine and formation of iodic acid. An analysis of the substance corresponded to the formula HI_7O_8.

On the Nature of Lead Amalgams. By Henry Fay and Edward North, 2nd. *Am. Chem. J.*, **25**, 216–231.—The authors have determined, by means of a Le Chatelier pyrometer, the freezing-points of a series of lead amalgams containing from 2 to 95 per cent. of lead. The results of the experiments seem to show that in the amalgam of lead and mercury there exists the compound Pb_2Hg, which is soluble in and isomorphous with lead; it therefore lowers the freezing-point of lead as it is successively added to it. This compound is insoluble in mercury, and hence does not lower the freezing-point of mercury; it may readily be separated from mercury by pressure, or very conveniently by means of the centrifugal machine. The freezing-point curve and

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the microstructure of the solid amalgams failed to show any evidence of a eutectic alloy.

The Basic Nitrates of Bismuth. By F. B. Allan. *Am. Chem. J.*, 25, 307–315.—Normal bismuth nitrate, the basic nitrate, $BiONO_3$, and the basic salt $6Bi_2O_3 \cdot 5N_2O_5$ were rotated at definite temperatures with varying amounts of nitric acid and water, the rotation being continued until the solid salt was in equilibrium with the solution. The composition of the solid was determined indirectly by estimating the acidity of the solution and the amount of bismuth in it. The salt $BiONO_3 + H_2O$ is the only one formed when bismuth nitrate is poured into water, provided the precipitate is quickly filtered. At 21°, the salt $Bi_{12}O_{13}(NO_3)_{10} + 9H_2O$ is in equilibrium with nitric acid solutions from 0.03 to 0.32 normal, and the salt $BiONO_3$ with solutions from 0.425 to 0.72 normal. At 50°, the salt $Bi_4O_5(NO_3)_2 + H_2O$ is in equilibrium with nitric acid solutions from 0.057 to 0.285 normal, and at 75° with solutions from 0.109 to 0.314 normal. At 50°, the salt $Bi_{12}O_{13}(NO_3)_{10} + 9H_2O$ is in equilibrium with nitric acid solutions from 0.285 to 0.466 normal, and at this temperature no other salt exists containing less N_2O_5.

The Effect of Annealing upon the Physical Properties and the Microstructure of a Low Carbon Steel. By Henry Fay and Stephen Badlam. *Tech. Quart.*, 13, 295–313.—Bars having the dimensions $18 \times 2\frac{1}{4} \times 1\frac{3}{4}$ inches, and containing 0.07 carbon, 0.058 sulphur, 0.10 phosphorus, and 0.32 manganese, were heated to different temperatures in a furnace made of a long porous cup wrapped with a platinum wire and enclosed in an insulating jacket of about 15 inches external diameter and 30 inches in length. The current used to heat the furnace was obtained from the three wire mains of an incandescent lighting circuit. For temperatures below 800°, 110 volts were used ; and for temperatures from 800° to 1300°, 220 volts were used. The temperatures were measured by a LeChatelier thermoelectric pyrometer. The tensile strength, the elastic limit, and the elongation were determined for each bar, and a microscopical examination of the structure was made on a specimen cut from each bar. The specimens seemed to show two points of maximum tenacity and elastic limit, one at 890° and another at 1125°. Below 850° the properties of the steel do not change to an appreciable extent, and between 890° and 1125° the steel shows a minimum value at 1000°. Annealing from temperatures above 1125° causes a decrease in strength with increasing temperature. The size of the grain is apparently constant at temperatures below 850°. At 890° the grain is very fine, and from temperatures above this there is a gradual increase in size up to 1125°, and a rapid increase above this point. Above 1100° the structure consists of parallel bands and striations sometimes crossing the grain junctions.

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Characteristics of the Chemical and Physical Properties of Cast-Iron. By THOS. D. WEST. *Sibley J. Eng.*, 15, 125–136.—A lecture delivered before Sibley College.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

On the Alkaloids of Ceanothus Americanus. By H. M. GORDIN. *Pharm. Rev.*, 18, 266–268.—In this preliminary note the author discusses the properties of the alkaloid, *ceanothine*, found by Gerlach (*Am. J. Pharm.*, 5, 332) in the root of Ceanothus Americanus. The variations in the melting-point of the "ceanothine" and its behavior with absolute ether indicate that it is not an individual compound. The attempt is to be made to either purify or separate it by means of absolute ether and the formation of derivatives.

Saw Palmetto Oil. By OSWALD SCHREINER. *Pharm. Rev.*, 18, 217–222.—Shermann and Briggs (*this Rev.*, 5, 109) found in saw palmetto a small amount of a volatile oil and a considerably larger quantity of fixed oil. The question having arisen as to whether the volatile oil is present in the berries or is formed from the fixed oil, the author has examined samples of oil from various sources. The results show that the volatile oil is not present in the dried berries but are not conclusive as yet concerning its exact source.

On the Chemical Composition of Monarda Oils. By W. E. HENDRICKS. *Pharm. Archives*, 2, 73–78.—The chemical composition of the oil of *Monarda Punctata L.*, as derived from experiments with authentic material, is as follows: About 60 per cent. of the oil is a phenol, largely thymol; of the non-phenol portion of the oil about 10 per cent. is an alcohol, the larger portion consisting of cymene and limonene. The oil of the related *Monarda fistulosa L.* was found to contain carvacrol and cymene but practically no thymol.

The Oil and Terpenes of Aralia Nudicaulis. By WILLIAM C. ALPERS. *Am. J. Pharm.*, 71, 370–378.—By extraction, of the dried root with petroleum benzene 1.726 per cent. of fixed oil, of a dark red color and consisting mainly of tri-olein, was obtained. Distillation with steam yielded about 0.04–0.12 per cent. of a yellow volatile oil having a pleasant aromatic odor. This oil consisted principally of a sesquiterpene, $C_{15}H_{24}$. In its reactions and properties this terpene seems to differ from the isomeric compounds identified and the name *Araliene* is proposed for it.

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BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

The Bio-Chemical Basis of Pathology. BY HENRY A. BUNKER. *Phila. Med. J.*, **7**, 441–446.—A discussion of the chemical transformations which take place in the processes of assimilation and disintegration within the living body. The article is not suited to brief review.

The Chemistry of Ipecacuanha. BY B. H. PAUL AND A. J. COWNLEY. *Am. J. Pharm.*, **73**, 57–66; 107–116.—After reviewing at some length the observations of previous experimenters, the authors present the results of their investigations, which go to show that ipecacuanha resembles cinchona bark, that it contains at least three alkaloids and probably others in small proportion. Of the three alkaloids which have been isolated one is uncrystallizable, but capable of forming crystallizable though extremely soluble salts. For this base the name emetine is reserved. The second alkaloid, named cephaeline, is crystallizable, less soluble in ether than is emetine, freely soluble in alcohol or chloroform; much more soluble than emetine in hot petroleum spirit and readily soluble in solutions of caustic alkali. The third alkaloid, named psychotrine, has been isolated in only small amount and exists in the drug in small proportion compared with the other two.

Physiological and Toxicological Effects of Tellurium Compounds, with a Special Study of Their Influence on Nutrition. BY L. D. MEAD AND WILLIAM J. GIES. *Am. J. Physiol.*, **5**, 104–149.—Experiments carried out on dogs brought to a state of nitrogenous equilibrium showed that non-toxic doses of tellurium (oxide, tellurate, tartrate, and tellurite) did not materially affect metabolism. Large doses retarded gastric digestion, and caused violent vomiting, loss of appetite, and somnolence. Intro-

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duced under the skin tellurium (tartrate) produced a marked effect, ending in paralysis and death from asphyxia. Tellurium was recovered in considerable quantity from most of the internal organs. Tellurium was eliminated in metallic form, as methyl telluride, and in a soluble form in small quantity, in the urine and bile. Methyl telluride invariably appeared in the breath a few minutes after the introduction of even very small quantities of tellurium and persisted for months after the last dosage. The secretion of acid in the gastric juice was markedly arrested by tellurium compounds, even in small amount. With men, the inhalation of tellurium oxide caused nausea, somnolence, depression, and constipation. Methyl telluride, when inhaled, induced sleepiness and nausea, and imparted its characteristic odor to the breath and the excretions from the skin. The action of tellurium in the body was found to resemble, in many respects, that of selenium, arsenic, and antimony.

Concerning Lipase, the Fat-Splitting Enzyme and the Reversibility of Its Action. By J. H. KASTLE AND A. S. LOEVENHART. *Am. Chem. J.*, **24**, 491–525.—Ethyl butyrate is so easily hydrolyzed by lipase that it has been found possible by means of this reagent to show the presence of lipase in a number of organs and tissues in the animal organism, notably in the liver, stomach and small intestine. Lipase is more stable than has hitherto been supposed but is almost completely removed from its solutions by repeated filtration at ordinary pressure; ethereal salts are hydrolyzed by it most rapidly at 40° C. and at 65° to 70° C. the enzyme is destroyed. The stability of certain ethereal salts toward lipase decreases with increase in molecular weight of the combined acid, the converse of this being found true for the hydrolysis of these ethereal salts by acids. Most of the common antiseptics exert a harmful effect on lipase, this being especially true of sodium fluoride, hydrofluoric acid and the acids generally. A study of the reaction with ethereal salts shows that the velocity of the reaction is not proportional to the active mass of the ethereal salt but is nearly proportional to the concentration of the enzyme. The reaction is incomplete, but approaches completion with very concentrated extracts of lipase or very small amounts of the ethereal salt. The coefficient of velocity as calculated for a reaction of the first order is not a constant but falls off as the reaction proceeds. By means of lipase a synthesis of ethyl butyrate from butyric acid and alcohol has been effected, showing that the reaction is a reversible one.

On the Toxicity of Normal Urine—By MELVIN DRESBACH. *J. Expt. Medicine*, **5**, 315–318.—From normal urine was obtained a substance or substances of an organic nature, possessing marked toxic properties. It is believed that the effects produced could not have been due to any of the organic bodies usually included

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in the list of compounds contained in normal urine, but the substance has not as yet been isolated.

On the Constituents of Jamaica Dogwood. By Paul C. Freer and A. M. Clover. *Pharm. Arch.*, **4**, 21–28; *Am. Chem. J.*, **25**, 390–413.—The authors have isolated from the bark of the Jamaica dogwood a number of interesting bodies, chief among which are *piscidic acid*, $C_{11}H_{12}O_7$, its ethyl ester and other derivatives. The presence of a number of other substances has been demonstrated, but lack of material prevented the determination of their exact chemical constitution. Evidence is presented to show that the substance called piscidine and hitherto supposed to be the active principle of Jamaica dogwood is a mixture and is pharmacologically inert.

CARBOHYDRATES.

A. G. Woodman, Reviewer.

Notes on Sugar Beets. By P. F. Trowbridge. *J. Am. Chem. Soc.*, **23**, 216–223.—As the average of twenty-five determinations, the author finds 0.919 to be the factor representing the relation of the sugar in the juice to the sugar in the beet. The average sugar content of a number of beets grown under precisely similar conditions was 12.61 per cent., the maximum being 18.2 per cent., and the minimum 8.7 per cent. Comparison of analyses by digestion with hot water and digestion with hot alcohol showed practically no difference. The highest sugar content was found to be in the middle portion of the beet, the lowest in the upper portion.

G. W. Rolfe, Reviewer.

On the Results of a Search for Other Sugars Than Xylose and Dextrose in the Products of the Hydrolysis of Wood from the Trunks of Trees. By F. H. Storer. *Bull. Bussey Inst. Harv. Coll.*, **2**, 437–467.—The current view that the wood of tree trunks contain much starch is an error which arose formerly from use of improper methods of estimating starch; *viz.*, hydrolysis by dilute acids. It is now known that when wood is hydrolyzed by acids much of the xylan contained is changed to xylose, till recently considered dextrose derived from starch. Testing trunk wood with barley malt shows little starch actually, although at certain seasons appreciable quantities are found in the twigs and roots. To solve the question of the origin of the great mass of sugar obtained in the spring from the trunks of maples and other trees, the author has studied the action of hydrolysis of acids on maple and birch wood, also cotton. The amounts of sugars formed were estimated with Fehling's liquor and the rotatory power of these sugars was noted. The method of investigation was novel in that an

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approximation to the true specific rotation was got in each instance by determining with Fehlings's liquor how much sugar was contained in 100 cc. of the impure product of the hydrolysis and calculating from this factor and the observed angle of rotation an approximation of the specific rotation, called by the author "*quasi* $(a)_D$." The values thus obtained fall somewhat higher than the true specific rotatory powers. As the result of many trials, no other sugars than xylose and dextrose were detected; but it was observed when the woods or the cotton were first treated with strong sulphuric acid, that considerable quantities of the wood dextrin of Bechamp (subsequently studied by Honig and Schubert and others) was formed, and that this dextrin is not readily changed to sugar by hydrolysis. Serious doubts are thus cast on the conclusions of those chemists (notably Fleschig and Winterstein) who have claimed that cellulose may be readily and completely changed into dextrose by treating with strong sulphuric acid and subsequent hydrolysis after diluting with water.

ASSAYING.

H. O. HOFMAN, REVIEWER.

The Calkins Umpire Ore Sampler. BY THE EDITOR. *Eng. Min. J.*, **71**, 534.—This continuous sampling machine consists of two buckets, one above the other, revolving in opposite directions. Each bucket has a central cone from which four radial partitions extend to the sides, thus giving four sectorial divisions, of which two are closed and two open at the bottom. Of 16 pounds of ore fed into the machine, 8 pounds remain in the upper bucket, 4 pounds go into the lower bucket and 4 pounds pass as sample into the receiver below. The machine is 3 feet, 7 inches high and weighs 55 pounds; it is easily cleaned. The claims made for it are too great, since its use must be limited, as is the case with all continuous sampling machines.

The Use of Iron in Assaying. BY R. W. LODGE. *Eng. Min. J.*, **71**, 329–330.—The author corrects the statement made editorially in a previous issue of the same journal (**70**, 734) that iron sulphide, formed in assaying sulphurous ores, is oxidized and fluxed. He shows that the amount of matte which will separate out is governed by the amount of alkali added to the charge; in fact, that with a sufficient amount of alkali, the whole of the matte will be held in solution or suspension. In the assay, all the sulphur, however, does not combine with the iron and the alkali; part of it is oxidized and passes off into the air.

Braun's "Coronet Rolls." BY THE EDITOR. *Eng. Min. J.*, **71**, 435–436.—These rolls, 2½ inches in diameter and 1¼ inches wide, are made of hardened steel and run in phosphor-bronze

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boxes; both rolls are operated by one crank; a feed plate at the front facilitates the insertion of a small button and a second plate at the back, closely wiping the bottom roll, prevents the cornet from dropping on the floor. The net weight of the machine is 57 pounds and the weight, when boxed for shipping, is 85 pounds.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Chemistry of Insecticides. BY F. T. SHUTT. *Canada Exp. Farms Rept.*, **1899**, 148–149.—An analysis of a sample of Paris green indicated 44.2 per cent. of arsenious acid, of which 4.56 per cent. was soluble in water. An emulsion of kerosene and crude carbolic acid with some soap, was found effective in destroying borers and bark lice. The addition of copper sulphate to the emulsion caused separation of the emulsion constituents and is not to be recommended. Addition of a strong tobacco decoction to Bordeaux mixture caused separation of the constituents, but only after standing some time. If used fresh, this would not injure the Bordeaux mixture.

Comparative Hide-Powder Tests. BY W. H. KRUG. *Leather Mfr.*, **12**, 10–11.—The hide-powder made by the Vienna Experiment Station having given unsatisfactory results recently, and being found acid in its character, the author and two others, undertook test analyses on quebracho extract, using the same sample, and employing hide-powder of the above-named make. Trials were made with the powder as furnished (*i. e.*, acid), and also after neutralization with sodium carbonate. The tabulated results show close concordance with the unneutralized powder; but after neutralization the absorption power of the powder decreases; the filtrate is turbid and contains tannin. After neutralization, twice as much powder is required in order that the filtrate may be free from tannin. A method of neutralizing and washing the powder is also described.

Comparison of the International Filter-Tube Method and the Official Hide-Powder Method. BY H. W. WILEY AND W. H. KRUG. *Leather Mfr.*, **12**, 9–10.—Test analyses on identical samples of oakwood extract, chestnut extract, mimosa extract, solid quebracho extract, valonia, and mimosa bark, were carried out by the filter-tube method in Prof. Procter's laboratory, and by the official method in the laboratory of the U. S. Dept. of Agriculture. The results of both series of tests are tabulated and show that the filter method gives lower non-tannins than the official method, and correspondingly higher tannins.

Concerning Retene, Petrolene, and Asphaltene. BY S. F.

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PECKHAM. *J. Franklin Inst.*, **151**, 50–61.—The paper is a protest against the use of the terms retene or retine, and petrolene, and asphaltene in reporting analyses of solid bitumens and bituminous minerals. The author prefers to report the percentage soluble in petroleum ether as "the petroleum ether soluble," and not as "petrolene," etc. A paper by Edward J. De Smedt (*Paving*, 1893) is discussed and several erroneous statements are shown; particularly in regard to the sulphur content of "retine," petrolene, and asphaltene. Retene is described in chemical literature as a body crystallizable from alcohol; the author could obtain no crystallized solid from the alcohol extract of California and other asphaltums. The term "retine" he fails to find. The article by De Smedt contains references to researches by Le Bel and Muntz as authority concerning retene, but the author fails to find such memoirs. In recent years, the terms petrolene and asphaltene have been loosely applied to the residues, soluble and insoluble, obtained with ethyl ether, petroleum ether, acetone, and other menstrua; the author asserts that the material dissolved from one asphaltum by these solvents, may be quite different from that extracted from another sample. An asphaltum having but a trace of chloroform soluble and only a small amount of turpentine soluble, may not be distinguished by the eye from one that dissolves to the extent of one-third or one-half in chloroform. It is stated that weathered asphalts yield a large percentage of chloroform soluble. A citation to an article by O. Hesse (*Arch. d. Pharm.*), frequently quoted in the literature, is shown to be erroneous, the article being by Otto Helm (*Arch. d. Pharm.*, III, **13**, 396). Analyses of grahamite by Miss Laura A. Linton shows it to contain about 50 per cent., each petrolene and asphaltene; according to De Smedt it should contain 11.045 per cent. of sulphur; analysis showed 0.6125 per cent. sulphur present. Other discrepancies in the sulphur content of albertite and several bitumens, as calculated according to De Smedt, and as found on analysis, are pointed out. It being admitted that the portions of different bitumens dissolved by petroleum ether may not be identical chemically, or even resemble each other, varying in their physical properties, the question is asked: Of what value is an analysis of asphalt by solution? The answer is that the value lies *only* in analyses made with the same solvents and under the same conditions, and especially as applied to different specimens from the same locality, as a means of comparison. It is useless to compare the results obtained from a Pacific coast asphaltum, using petroleum ether made from California petroleum, with those obtained from Trinidad or Bermudez asphaltum dissolved in ethyl ether, or petroleum ether from Eastern petroleum. A uniform method by the same solvents should be adopted by all who are engaged in analyzing asphaltum.

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Aluminium at the Paris Exposition (1900). By JOSEPH W. RICHARDS. *J. Franklin Inst.*, **151**, 107–114.—The progress of the aluminium industry as shown at the five international exhibitions held in Paris, in 1855, 1867, 1878, 1889, and 1900, is interestingly described. Up to 1900 the material was all obtained by the Deville process, using metallic sodium; but in 1889 a great reduction in price with consequent large increase in the use of the metal was noticed, chiefly due to the cheap production of metallic sodium by the processes of Castner and Netto. At this time the Cowles' alloy products were first shown. In 1900 *all* of the metal exhibited was made by electrolytic processes; the production amounted to 7,000 tons and the price was 30 cents per pound. A list of the firms producing aluminium and a description of their exhibits in detail then follows.

A Discussion of Recent Developments in the Fire-Proofing of Wood. By JOSEPH L. FERRELL. *J. Franklin Inst.*, **151**, 161–177.—The first seven pages of the article are filled with a rambling commentary upon the "old methods of fire-proofing" and the faults of the machinery used; the time consumed and cost of the chemicals are claimed to make the processes prohibitive. Then the author gives a very general account of the "new process." Instead of low pressures and long time, high pressures for short times were tried; steaming and vacuum are discarded. (*Compare this Rev.*, 7, 64.) Pressures from 50 to 1,200 pounds were tried and "the results noted." To the reviewer at least, the article would have had greater interest if some of these results were stated. It was, however, discovered "that each thickness of each wood had its exponent of resistance to compression, but the greater pressures were apt to overcompress and distort the wood." This is obviated by the use of a hydraulic accumulator by which uniform pressure and more rapid saturation are obtained. Some details and a drawing of portions of the apparatus are given. Concerning the chemicals available for fire-proofing previous to this investigation, phosphate of ammonium is ranked first in efficiency and ammonium sulphate next. Both of these are too expensive, render the wood brittle, more hygroscopic and corrode metals with which they come in contact. But now, after years of experiment, two formulae have been discovered, which will reduce the cost of chemicals to less than one-third of what it has been, and the saturated wood is free from the defects of the old process. It retains its color, does not corrode metals, is not hydroscopic nor brittle, will take paint and varnish and the chemical does not volatilize. The time of treatment is very short and penetration is complete. No hint as to the nature of these chemicals is given "as the patents are not sufficiently advanced." Large timbers, as well as boards, can be treated. Some illustrations of a burning test applied to two

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small buildings, exactly alike, but one made of fire-proofed wood, are given, but the description is very meager.

A Brief Sketch of the Essential Requisites of "Powder" as Distinguished From "Explosives." By W. J. Williams. *J. Franklin Inst.*, **151**, 194–207.—The author defines a "powder" as a means of propulsion for projectiles. An "explosive" is a means of producing powerful shattering effects. In a powder, the chemical changes are comparatively slow or progressive, so that the whole of the power is not released in the shortest possible period, but gradually; an explosive develops its total energy in the shortest possible period of time. A powder burns; an explosive detonates; a powder pushes while an explosive strikes a shattering blow. The requisites of a powder are then summed up under the following heads: (1) The velocity developed; (2) the pressure attained; (3) specific gravity and gravimetric density; (4) granulation; (5) temperature attained during combustion; (6) susceptibility to ignition; (7) smoke and ash; (8) friability; (9) sensitiveness to shock; (10) suitability for loading by machinery; (11) sensitiveness to environment, such as heat, moisture, etc.; (12) stability. Each of these headings is then taken up in detail and considered at length, but no condensed abstract can be made.

High Explosives: Their Uses in Peace and War. By E. L. Zalinski. *International Monthly*, **1**, 676–692.—In this popular discussion is given a résumé of some of the more common high explosives, their composition, properties and the conditions under which they may be used. Nitroglycerine; guncotton; dynamites and their various combinations as blasting gelatine, explosive gelatine, and gelatine dynamites are briefly considered, and also the Sprengel group. The picric acid class is given some attention because of its public notoriety rather than intrinsic merit. It is pointed out that the presence of small amounts of metallic oxides in these explosives constitute an element of unusual danger. This class requires very powerful detonators to evolve their full power and when not fully exploded they evolve dense clouds of noxious fumes. The use of lyddite in war has demonstrated that incomplete explosions are frequent but in even a greater number of cases entire failure to explode occurs. The same result is likely to follow the use of melinite. Liquid air as an explosive is powerful but the chances of its being used industrially or for war, are small. All high explosives are capable of several orders of detonation, from mere ignition to the most powerful explosion; these differences may be caused by the nature of the "tamping" or by the character and manner of initial ignition and explosion. With all high explosives, mercury fulminate is best adapted to educing the

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maximum power of the explosive ; and it is also important that the proper quantity of fulminate be used. The more insensitive the explosive the greater the charge of fulminate required. The position of the exploder cap in the charge is also very important. A table of the relative force of various high explosives is given, based on gunpowder as unity ; in this, nitroglycerine stands at 12 ; blasting gelatine, 16 ; dynamite No. 1, at 10 ; and lyddite and melinite, 3 each. The influence of the specific gravity in obtaining results from explosives is discussed briefly, and it is then shown that the time element in the explosion governs the energy realized. The actual energy secured seems to be more or less independent of the chemical constitution. The methods of using high explosives are then considered somewhat at length.

Rubber in Guatemala. By Jas. C. McNally. *U. S. Consular Rep.*, **65**, 371–375.—This is a general description of the cultivation and collection of crude rubber in that country. Planting and cultivation of the *Castilloa elastica* is now well established ; the tree develops in from seven to nine years, and then may be tapped twice a year. The yield is from two to four pounds of milk yearly, and the resulting rubber is worth from one to two dollars. The method and precautions to be observed in tapping are stated, and also the process of coagulating the juice.

The Condition, Prospects, and Future Educational Demands of the Chemical Industries. By Wm. McMurtrie. *J. Am. Chem. Soc.*, **23**, 71–89.—This article is the presidential address delivered at the Chicago meeting of the Society, December 27, 1900. It contains an excellent review of the progress of the chemical industries in this country, especially during the last two decades. Tables showing the values of chemicals imported and exported during this period are given, from which it is seen that in certain lines an enormous growth in our domestic industries has taken place ; but in other directions there is still necessity for further developments of our own sources of crude materials. The question of the proper education of technical chemists is also ably discussed.

A Comparative Method of Determining the Fusing-Points of Asphalts. By Chas. F. Mabery and Otto J. Sieplein. *J. Am. Chem. Soc.*, **23**, 16–20.—The method consists in heating the specimen in a narrow beaker which is supported in a glycerine-, water-, or air-bath. The dimensions of a convenient apparatus are given and by maintaining certain constants the results are reasonably close. The page number given for this article in the index on the cover is incorrect.

Manufacture of Rubber in the Philippines. By G. D. Rice. *Western Electrician*, **27**, 332.—A description of the methods of preparing crude rubber.

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The Manufacture of Uranium Compounds. By J. Ohly. *Min. and Sci. Press*, **82**, 125–134.—A complete analysis of carnotite (potassium-sodium vanadio uranate) by Hillebrand is quoted, and determinations of U_3O_8 in six samples by the author are the only special features to note in the article. The author finds that Hillebrand's analysis was of a selected ore sample, and that the average value in uranium oxide is seldom above 6 per cent., although two of the author's analyses show 8.68 and 17.06 per cent. U_3O_8, respectively. The uranium is extracted by treating the ore with dilute nitric acid, and precipitating the uranium with caustic soda when a sodium uranate, $Na_2U_2.6H_2O$, contaminated with iron, alumina and lime, separates as crude "uranium yellow." From this the refined uranium oxide, or sodium uranate is obtained. The methods of extracting uranium from pitchblende are also explained. Uranium compounds are employed for making a fluorescent, greenish-yellow glass, for orange and black glazes on porcelain and in china painting. The carbide of uranium is employed as a substitute for platinum in pyrometers owing to its high melting-point, and as an addition to steel for improving its toughness and tensile strength.

The Cause of Foaming in Locomotive Boilers. By C. Herschel Koyl. *Railroad Gazette*, **32**, 663, 664.—The author believes that foaming is caused by fine particles of suspended matter in the boiler water, or at least that it will not foam unless such suspended matter is present. He discredits the idea that free alkali or alkaline salts alone will cause foaming. Experiments are described in which he introduced pure sodium carbonate into boiling distilled water without causing foaming; but the addition of a fine insoluble powder, such as calcium carbonate or magnesia alba, caused foaming. He shows that the introduction of rain or other soft water into a boiler previously fed with hard water, causes foaming owing to the disintegrating action of the pure water on the scale left by the hard water. The addition of alkali to the feed water produces the same effect, if the boiler has been previously scaled, because of its disintegrating action on the scale. Three physical conditions are recognized in boiling liquids: "bumping," when the steam rises in great bubbles, which throw the liquid about, the thumping being produced by the liquid falling back to its place; "quiet boiling" when the steam enters the water freely and rises through it without difficulty; "foaming," when steam and water are so intimately mixed that they cannot be easily separated and the liquid is carried out with the bubbles of steam. The author explains the phenomena of supercooling and superheating and then reasons that pure water in a clean boiler tends to become superheated at the heating surface and therefore "bumps," but the presence of small quantities of foreign matter, such as all ordinary water contains, furnishes

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small surfaces from which the steam is more frequently liberated, generally resulting in quiet boiling; but if the number of particles be increased, the liberation of steam throughout the water in the vicinity of each particle, causes such numerous bubbles, which so fill the mass of liquid, that it occupies the whole space of the boiler, making it impossible for the bubble to break at the surface, without throwing off water mechanically with the steam. The ordinary cases of foaming produced by the addition of a precipitant, or of alkaline feed water, or of muddy water, or of artificially softened water, are then considered in some detail.

The Treatment of Water for Boilers. By H. Stillman. *Railroad Gazette*, **32**, 675.—This is a general discussion of the methods of purifying water for locomotives.

Fertilizers.—*Canada Exp. Farms Rpt.*, **1899**, *137–143; Conn. Sta. Rpt.*, **1899**, (*I*), *92; Ind. Purdue Univ. Spec. Bull., Aug.*, **1900**; *La. Sta. Bull., No.* **58**, *189–264; Mass. Hatch Sta. Bull., No.* **68**; *Me. Sta. Bull., No.* **66**; *No.* **72**; *Miss. Sta. Bull., No.* **64**; *N. C. State Bd. Agr. Bull., No.* **21**; *N. J. Sta. Bull., No.* **145**; *N. Y. Sta. (Geneva) Bull., No.* **177**; *Penna. Dept. Agr. Bull., No.* **54**; *Penna. Dept. Agr. Rpt.*, **1898**, *821–974; R. I. Sta. Bull. Nos.* **67**, **70**; *S. C. Sta. Rpt.*, **1899**, *9–16; 32–34; S. C. Sta. Bull., No.* **54**; *W. Va. Sta. Bull., No.* **65**; *Wis. Sta. Bull., No.* **86**; *Vt. Sta. Bull., Nos.* **79**, **80**; *Ky. Sta. Rpt.*, **1898**, *16*.

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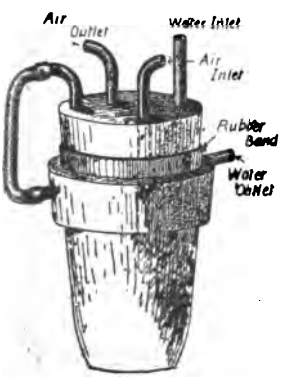

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CHEMIST.—Expects to be open for engagement by August 1, 1901. Two years in charge of a commercial laboratory. Late chief chemist for Smelting Company, and at present cyanide chemist. Graduate of eastern university. Desires to locate in the east. Address, "Cyanide," care Journal of the American Chemical Society. 7

CHEMIST.—Over ten years of practical experience in both laboratory and factory, and having best of references, wishes position. Address "G. S.," 109 Pulaski St., Brooklyn, N. Y. 6

OPEN FOR ENGAGEMENT.—The general manager of a firm of manufacturing chemists has resigned and is open to proposals to take a similar position with a New York City firm. Is an advertising expert and experienced manager of agents. Competent to take entire charge of a business or could act as head of a department. Address Dr. C. C. Fite, 102 W. 93d St., New York. 6

CHEMIST.—Columbia graduate, age 22, desires to change position for one in or near New York City. Excellent reference from present engagement. Manufacturing chemist preferred, but would go into the analytical laboratory. Address "Chemist," care Journal of American Chemical Society. 6

WANTED.—Position as instructor in organic chemistry at a technical school or college. Ph.D. from Yale University, and three years' experience as instructor. Best of references. Address "A. H. S.," care Journal of American Chemical Society. 6

A GRADUATE of American and European Universities, at present lecturer in chemistry in a prominent college, wishes a position as professor. Best testimonials and recommendations. Address "W. J.," care Journal of American Chemical Society. 6

CHEMIST.—Graduate of university, two years' laboratory experience, wishes position. Best of references. Address "Chemical Engineer," care of A. W. Morre, 160 Fifth Avenue, New York City. 6

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 7.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

PHYSICAL CHEMISTRY.

H. M. GOODWIN, REVIEWER.

Differences of Potential between Metals and Non-Aqueous Solutions of Their Salts. II. BY LOUIS KAHLENBERG. *J. Phys. Chem.*, 4, 709–714.—This is a continuation of previous work (*this Rev.*, 6, 11), throwing doubt on the applicability of Nernst's theory to cells composed of non-aqueous solutions. Silver nitrate in pyridine and in acetonitrile and cadmium iodide in acetonitrile were the solutions used. As only five concentration cells were measured and no account taken of the P.D. at the liquid-liquid junction in the computation, further experiments are certainly desirable before discarding Nernst's theory, or questioning its applicability "even in the case of aqueous solutions."

Gas-Polarization in Lead Accumulators. BY C. J. REED. *J. Phys. Chem.*, 5, 1–17.—The author attempts to disprove the results and conclusions published by Nernst and Dolezalek (*Ztschr. für Elec. Chem.*, 1900). For details of the calculations and experiments reference must be made to the article.

Laboratory Apparatus for Decomposition Voltages. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 5, 133–136.—A milliammeter is placed in series with the electrolytic cell around the terminals of which a high resistance voltmeter is connected. The impressed electromotive force is gradually increased, while the readings of the ammeter and voltmeter are simultaneously noted. The voltage corresponding to the sudden increase of current through the cell is taken as the decomposition voltage. Although no great accuracy is claimed for the method, it is a simple and instructive laboratory experiment.

On the Dielectric Constants of Nitriles. BY HERMAN SCHLUNDT. *J. Phys. Chem.*, 5, 157–170.—The following values

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were obtained by Drude's well known method of electrical oscillations.

Solvent.	$t°$	D.C. (Air = 1.)
Hydrocyanic acid	21	95
Acetonitrile	21	36.4
Propionitrile	22	26.5
Butyronitrile	21	20.3
Isopropyl cyanide	24	20.4
Valeronitrile (*n*)	21	17.4
Isobutyl cyanide	22	17.95
Capronitrile	22	15.5
Benzonitrile	21	26.0
Benzyl cyanide	21	14.9
Toluonitrile (ortho)	23	18.4
Pyridine	21	12.4
Quinoline	21	8.8

These results taken in conjunction with the available results on the molecular conductivity of silver nitrate in the above solvents show that the Nernst-Thomson rule is verified only in the case of the homologous series,—aceto-, propio-, and butyro-nitriles. The molecular conductivity of silver nitrate in propionitrile, on the other hand is much greater than in benzonitrile, although the D.C. of both solvents is nearly identical. A pyridine solution conducts better than a corresponding butyronitrile solution, although the D.C. of the former solvent is only 61 per cent. of that of the latter.

Conductivity measurements of salts in liquid hydrocyanic acid which are now being made will be of much interest in view of its abnormally high dielectric constant.

The Electromotive Force of Polarization of Electrolytic Cells for Very Small Current Densities. By Barry Mac Nutt. *Phys. Rev.*, **8**, 237–243.—The variation of the e.m.f. of polarization with the time was noted when a current was passed through such reversible cells as zinc electrodes in zinc sulphate, copper electrodes in copper sulphate, etc. It was found that if the cell had been standing on open circuit for a long time that the polarization gradually decreased with the time. If, however, on closed circuit the current was suddenly reduced, the polarization gradually increased with the time. The author attempts to explain these results by assigning a different osmotic pressure to the ions under the different conditions of the experiment. No reference is made to the undoubted concentration differences arising at the electrodes.

On the Application of the Dissociation Theory to the Electrolysis of Aqueous Solutions Containing Two Electrolytes with a Common Ion. By J. G. MacGregor. *Phys. Rev.*, **8**, 129–140.—The author discusses the results of Schräder and Hopfgartner by comparing them with the relative amounts of ions transferred in the electrolysis of invert electrolytes, as calculated

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by the relation $\alpha_1 N_1 v_1 \mu_\infty / \alpha_2 N_2 v_2 \mu_{\infty_2}$, the values of α (electrolytic dissociation) being obtained by the graphical method described by the author in 1896. The agreement was found to be fairly satisfactory in the case of mixtures of NaCl and HCl, and of KI and KCl, but less so in the case of $BaCl_2$ and HCl. The discordant results with $CuSO_4$ and H_2SO_4 were explained on the assumption of the presence of acid salt in the solution.

The Magnetic Molecular Susceptibility of Salts of the Iron Group. By O. Liebknecht and A. P. Nills. *Phys. Rev.*, 10, 215–228.—The method employed was that described by du Bois, in which a paramagnetic solution is diluted with a diamagnetic solvent until the motion of the meniscus of the resulting mixture in a capillary tube placed in a strong magnetic field became zero. The halogen salts, nitrates and sulphates of chromium, manganese, iron, cobalt, nickel, and copper were investigated with the following general results: The molecular susceptibility increases from chromium to manganese and iron, and then decreases to copper. With the halogens there is an increase from the fluoride to chloride, with a following decrease to the iodide. Simple additive properties do not appear to be present. Experiments on the effect of a magnetic field on surface tension as indicated by the "dropping" method confirmed Quincke's results and conclusions in the case of paramagnetic solutions. In the case of diamagnetic water, the dropping could be completely stopped by a field in which the magnetic force acts upward against the hydrostatic pressure. Unmagnetic solutions dropping in an atmosphere of illuminating gas were uninfluenced by a magnetic field.

SANITARY CHEMISTRY.

E. H. Richards, Reviewer.

A Study of the Relative Value of Lacmoid, Phenacetolin, and Erythrosine as Indicators in the Determination of the Alkalinity of Water by Hehner's Method. By Joseph W. Ellms. *J. Am. Chem. Soc.*, 21, 359–369.—The author concludes that all the indicators are suitable with proper care and skill, but that if uniformity of results within very narrow limits is desired the preference should be given to erythrosine.

Measurements of "Turbidity" in Water. By W. P. Mason. *J. Am. Chem Soc.*, 21, 516–517.—The turbidity of the water is compared with that of a standard kaolin solution (1 gram per liter) in a 2-foot tube and is expressed in parts per million.

Standard Methods of Water Analysis. Preliminary Report, *Comm. Am. Pub. Health Assoc.*, Geo. W. Fuller, Chairman. *Eng. Record*, Oct. 27, 1900; *Science*, 12, 906–915; *Ann. Rept. Am. Pub. Health Assoc.*, 26, 315–316.—The limits of an ab-

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stract will not permit of any extended notice of the twelve different chemical tests discussed in the report.

The Artesian Basins of Wyoming. By Wilbur C. Knight, *Wyo. Expt. Sta. Bull.*, **45**, 1–250.—In connection with a discussion of water-bearing zones the author gives analyses of twenty-seven wells and springs from various geological formations in the state. These range from 8 grains per gallon of total solids to 1115 grains; from 0.7 to 40 grains $CaCO_3$; from 0.2 to 73 grains $MgSO_4$; with other ingredients in similar fluctuating proportions. On pages 182 and 183 will be found a summary of the character of the water to be expected from seventeen horizons. As usual the purest water is found in the Archean.

The Determination of Phosphates in Potable Waters. By A. G. Woodman and L. L. Cayvan. *J. Am. Chem. Soc.*, **23**, 96–107.—After a résumé of previous work and a description of the methods used, the authors give with diagrams the results of their study of the effect of temperature on the color developed and on dehydration of silica. A colorimetric method is described which is applicable to colorless well waters but has not yet been made suitable to colored surface waters.

Permanent Standards for Use in the Analysis of Water. By Daniel D. Jackson. *Tech. Quart.*, **13**, 314–326.—The author says that colorimetry plays such an important part in the analysis of water that standards for comparison are in constant use. Much time would be saved if permanent solutions could be kept on hand and the paper is an account of the preparation of six of these standards, *viz.*, for color, turbidity, nitrogen as ammonia, as nitrite, and as nitrate, and for iron.

Description of Experimental Filter Plant at Pittsburgh, and Results of Experiments. By Morris Knowles. *J. N. E. Water Works Assoc.*, **15**, 148–188.—After a discussion of the apparatus and methods used eight tables of results of the chemical examination of the water of the Allegheny river and of the effluents of the sand and mechanical filters are given. The following summary of the general results for the seven months ending August 31, 1898 will be of interest.

	Percentage of constituents removed.			
	Sand filters.		Mechanical filters.	
	No. 1.	No. 2.	Warren.	Jewell.
Color	73	73	88	88
Nitrogen as alb. ammonia	47	48	53	57
Free ammonia	10	10	5	10
Nitrites	..	..	..	..
Nitrates	—13	3	3	8
Chlorine	2	5	6	12
Total solids	30	31	38	39
Suspended matter	100	100	98	98
Total hardness	—34	—35	8	10
Alkalinity	—45	—46	33	31
Sulphuric acid	..	..	—62	—38

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ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

A Simple Test to Distinguish Oleomargarine from Butter. BY CHARLES LATHROP PARSONS. *J. Am. Chem. Soc.* 23, 200–202.—A 100 cc. beaker is half filled with sweet milk; this is heated to boiling and from 5 to 10 grams of butter or oleomargarine added. The mixture is stirred with a wooden splinter, about the size of a match, until the fat is melted. The beaker is then placed in cold water and the milk stirred until the fat has hardened. At this point the fat, if oleomargarine, can easily be collected together into one lump by means of the rod, while if butter it will granulate and cannot be so collected.

A Rapid Method for the Detection of "Aniline Orange" in Milk. By HERMANN C. LYTHGOE. *J. Am. Chem. Soc.*, 22, 813, 814.—The presence of "aniline orange" is shown by the pink color given to the curd when hydrochloric acid is added to the milk in testing for formaldehyde by boiling with hydrochloric acid and ferric chloride.

Detection of Foreign Coloring-Matter in Spirits. BY C. A. CRAMPTON AND F. D. SIMONS. *J. Am. Chem. Soc.*, 22, 810–813.—The method is based on the insolubility in ether of the coloring-matter of caramel and prune juice. The test is made by shaking the sample with ether, separating the ethereal from the watery layer, and comparing the color of the latter with the color of the original spirits by means of the tintometer. Genuine spirits gives up about 40 to 50 per cent. of its color, while spirits colored by caramel alone are entirely unaffected, the ethereal layer remaining water-white.

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The Composition of American Wines. By W. D. Bigelow. *U. S. Dept. Agr., Div. of Chem., Bull.* **59**, 1–76.—This bulletin contains tabulated results of analysis of all samples of American wine having a definite history or origin, a discussion of the interpretation to be placed on the analytical results and a description of the methods of analysis employed.

Report on Food Products for 1900. By B. W. Kilgore and W. M. Allen. *Bull. N. C. State Board of Agr.* (*1900*), **12**, 1–61.—Details are given of the examination of about 500 samples under the North Carolina "Pure Food Law" of 1899. Especial prominence is given to the presence of preservatives and artificial coloring-matters.

The Composition of Jellies and Jams. By L. M. Tolman, L. S. Munson, and W. D. Bigelow. *J. Am. Chem. Soc.*, **23**, 347–353.—Analyses are given of over forty samples of fruit and fruit products of known origin. The determinations made include total solids, ash, total acid (as H_2SO_4), proteids ($N \times 6.25$), reducing sugars and cane-sugar. The analytical methods are briefly described.

Cloves. By A. McGill. *Canada Inland Revenue Dept., Bull.* **73**, 1–14.—Twenty-eight samples of whole cloves have been examined as follows: Moisture was determined by drying the ground sample over sulphuric acid *in vacuo* for 24 hours; the total volatile matter was determined by drying the sample at 98° C. for 18 hours; and the total extractive matter (fixed and volatile oils) was found by extraction of the dry substance with petroleum ether. From the results obtained the author is of the opinion that no sample of cloves of good quality should yield less than 14 per cent. of volatile oil when treated in the manner described.

Twenty-fourth Ann. Rept. Conn. Agr. Expt. Sta. (**1900**), **Part II**, 105–218.—This bulletin contains the results of further examination of food products under the Connecticut Pure Food Law. In all, 1339 food samples have been examined during the year. A detailed description is given of the methods employed in the examination of lard, olive oil, and baking-powders, together with the results of analysis of numerous samples. Several samples of spring water were also analyzed.

On Heptane from Coniferous Trees. By W. C. Blasdale. *J. Am. Chem. Soc.*, **23**, 162–164.—Specimens of the exudation from five species of coniferous trees were examined and heptane found in two of them, *Pinus Jeffryi* and *P. Sabiniana*.

The Complete Analysis of Feeding Materials. By C. A. Browne, Jr., and C. P. Beistle. *J. Am. Chem. Soc.*, **23**, 229–

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236.—The authors have made a detailed analysis of a sample of distillery waste and point out the errors which may result from the action of the solvents employed upon the pentosans. Malt extract and even water alone were found upon prolonged digestion to dissolve a considerable amount of pentosans. Thus the percentage of dextrin and of starch obtained in the usual method of analysis might be appreciably above the truth.

The Determination of Pentosans. By G. S. Fraps. *Am. Chem. J.*, 25, 501–508.—When vegetable substances are distilled with hydrochloric acid there may be formed besides furfural a substance which precipitates phloroglucinol and is destroyed by redistilling. The author uses the term "furaloid" to designate this substance. Furaloid-yielding bodies, which were found in all the materials tested, are hydrolyzed by boiling 1.25 per cent. sulphuric acid and lost in the subsequent evaporation. Furaloid is not formed by the action of hydrochloric acid on the pentose sugars.

Methods of Determining Proteid Nitrogen in Vegetable Matter. By G. S. Fraps and J. A. Bizzell. *J. Am. Chem. Soc.*, 22, 709–719.—The authors have made a study of the applicability of phosphotungstic acid and bromine as precipitants for the proteids of vegetable materials and reach the following conclusions: Phosphotungstic acid does not precipitate proteids completely at 90° or 100°, but at 60° precipitates (at least in the case of vegetable materials) very nearly the same amount of nitrogen as copper hydroxide. Bromine is not a suitable precipitant for proteids in vegetable materials and extraction of the proteids with hot water does not always give concordant results. The method open to the fewest objections seems to be the method proposed by Stutzer (*J. f. Landw.*, 28, 103), which is the one in general use.

Loss of Sulphur in Preparing Ash of Plants. By G. S. Fraps. *J. Am. Chem. Soc.*, 23, 199, 200.—The amount of sulphur was determined in a variety of plants by two methods: *a*. 10 grams were burned to an ash at the lowest possible temperature, and the sulphur determined in it. *b*. 10 grams substance were burned with the addition of 20 cc. of a solution of calcium acetate (29.2 grams per liter). The sulphur obtained by *a* was from 4 to 100 per cent. less than that found by *b*. It was not determined whether or not all the sulphur was retained by the calcium acetate.

A Method for the Determination of the Availability of Organic Nitrogen in Commercial Fertilizers. By John Phillips Street. *J. Am. Chem. Soc.*, 23, 330–338.—An amount of material equivalent to 0.075 gram of nitrogen is weighed into a 300 cc. Erlenmeyer flask, 100 cc. of neutral 1.6 per cent. potas-

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sium permanganate added, and the mixture digested on the steam-bath for twenty minutes with occasional shaking. The solution is filtered and washed with 125 to 150 cc. of water. The nitrogen in the undigested residue is determined by the usual Kjeldahl process. Tests on a considerable variety of fertilizers show that the method places them in about the same rank as that assigned by vegetation tests and agricultural experience.

The Chemical Composition of Maryland Soils. By F. P. VEITCH. *Md. Agr. Expt. Sta. Bull.*, 70, 64–114.

Paraffine as a Substitute for Ether in the Preparation of Extract of Nux Vomica, U. S. P. By FERDINAND A. SIEKER. *Pharm. Rev.*, 19, 56–61.—Paraffine is preferred to ether because it is cheaper, is not dangerously inflammable, and can be easily separated after congealing; it separates practically everything that ether separates, as well as an insoluble brown substance that ether does not separate.

The Accurate Measurement of Tints and Shades of Colors. By OSWALD SCHREINER. *Pharm. Rev.* 19, 61–66.—This is a description of the construction and manner of using the well-known Lovibond tintometer.

The Detection of Methyl Alcohol in Pharmaceutical Preparations. By FERDINAND A. SIEKER. *Pharm. Rev.*, 19, 117–120.—The author employs the well known method of oxidizing a part of the alcohol vapor by a hot oxidized copper spiral. The presence of methyl alcohol is shown by the odor of formic aldehyde.

The Specific Gravity Tables of the U. S. Pharmacopoeia. By A. B. LYONS. *Pharm. Rev.*, 19, 101–107.—The author criticizes the lack of unity of plan of the tables as arranged at present and submits two tables, one of the strength of hydrochloric acid of different densities and the other a specific gravity table for glycerine, as models for future tables of this kind.

The Assay of Coca. By WILLIAM R. LAMAR. *Am. J. Pharm.*, 73, 125–131.—The author expresses the opinion that the discordant results in the assays previously published are due to the extreme instability of the alkaloids accompanying coca. For this reason any excess of strong alkali must be avoided and the strength of acid employed for removing the alkaloids from the menstruum must be carefully regulated. Kerosene oil is recommended as the best medium for the exhaustion of coca and detailed directions are given for the carrying out of the assay. It is concluded that the coca leaf, to be of good quality, should assay by the process described about 0.7 per cent. of total alkaloids.

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Assay of Crude Drugs. By H. M. Gordin. *Am. J. Pharm.*, 73, 159–168; 211–220.—The author considers that a standard method for the assay of a given drug should be one in which the exhaustion is so complete that no alkaloid can be found in 5 grams of the dregs and further that the operations involved should be such as are not liable to injure the alkaloid in question. This question of a standard method has been worked out for some of the more important medicinal drugs.

The Assay of Belladonna Root and Its Solid Extract. By Arthur Wayne Clark. *Am. J. Pharm.*, 73, 22–29.—The essential feature of the method described consists in hot extraction of the drug, using a return-flow condenser. Consequently there is little resinous material extracted and the subsequent "shaking-out" is rendered easier. The process of assay is minutely described.

Adulterations of Essential Oils. By Geo. R. Pancoast and Lyman F. Kebler. *Am. J. Pharm.*, 73, 1–10.—The authors give a list of a number of essential oils with the adulterants usually found in them, together with a brief summary of the methods for their detection.

Thymoquinone in Wild Bergamot Oil. By I. W. Brandel and E. Kremers. *Pharm. Rev.*, 19, 200–203.—Thymoquinone has been found in wild bergamot oil (*Monarda fistulosa L.*), probably the first case in which this has been isolated from a volatile oil. The suggestion is made that the increased color of the oil on standing is due to the formation of colored derivatives of thymoquinone.

Hydrothymoquinone in Wild Bergamot Oil. By I. W. Brandel and E. Kremers. *Pharm. Rev.*, 19, 244–246.—The substance melting at 140°, previously reported by the authors as occurring in *Monarda fistulosa L.*, has been identified as hydrothymoquinone.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

Orthophenylsulphonebenzoic Acid and Related Compounds. By Hall Canter. *Am. Chem. J.*, 25, 96–110.—*o*-Tolylphenylsulphone (m. p. 68°), prepared by means of the Friedel and Crafts reaction from *o*-toluenesulphone chloride, was oxidized to *o*-phenylsulphonebenzoic acid. The acid is anhydrous and melts at 267°–268°. Graebe and Schulteiss, who claim to have made this compound by treating phenylthiosalicylic acid with strong nitric acid, state that it contains one molecule of water of crystallization and that it melts at 99° when hydrated and at 152° after being heated at 105°. The barium, magnesium, calcium, stron-

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tium, zinc, copper, and sodium salts of *o*-phenylsulphonebenzoic acid were prepared. The chloride of the acid melts at 262.5°–263.5° and was converted into an amide, which sublimed and melted indistinctly at 220°–257°, and into an anilide, which melted at 234°–235°. *o*-Benzoyldiphenylsulphone was prepared by condensing the chloride of *o*-phenylsulphonebenzoic acid with benzene in the presence of aluminium chloride. The compound was found to be identical with the substance prepared by the same reaction from the chlorides of *o*-sulphobenzoic acid. The sulphone gave benzoic acid when it was fused with potassium hydroxide.

On the Importance of Formic Aldehyde as a Product of the Partial Combustion of Organic Compounds. By S. P. Mulliken, with J. W. Brown and P. R. French. *Am. Chem. J.*, **25**, 111–117.—In studying a test for methyl alcohol Mulliken and Scudder (*this Rev.* 7, 82) showed qualitatively that formic aldehyde is one of the most common products of the partial oxidation of organic compounds by copper oxide, and that its appearance in minute traces as a result of such oxidation should not be accepted as sufficient proof that the substance burned contains a methoxyl group. In order to determine to what extent formic aldehyde is formed when organic compounds are partially oxidized, a quantitative study of the oxidation-products of a number of substances was made. The method of carrying out the experiments was that used by Loew for the preparation of formic aldehyde from methyl alcohol. The gaseous products of the reaction were collected in water. In order to separate the acetic aldehyde from the formic aldehyde formed, the solution of the gases was boiled in a flask provided with a return condenser. The acetic aldehyde, which was removed from the solution by this procedure, was condensed and determined. This method of separation was found to be simple and exact. The compounds chosen for oxidation were carefully purified. The amount of substance used in each experiment varied from 40 to 275 grams. The substances used and the per cent. yield of formic aldehyde in each case were as follows: acetone, 0.22; ethyl alcohol, 0.44; pentane, 0.88; acetic acid, 0.84; ethyl oxide, 1.86; amylene, 2.01; normal propyl alcohol, 2.72; trimethyl carbinol, 5.17.

On the Non-Existence of Trivalent Carbon. By James F. Norris. *Am. Chem. J.*, **25**, 117–122.—The author, while studying the action of sodium on triphenylchlormethane, came to the conclusion that the metal caused the elimination of hydrogen chloride from the compound, and that a highly unsaturated compound was formed, which was identical with a substance previously described by Gomberg. According to Gomberg, who prepared the compound by treating triphenylchlormethane with zinc, the substance was a free radical, triphenylmethyl, $(C_6H_5)_3C$—,

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the reaction consisting simply in the removal of the halogen atom from the compound. In order to test the view that hydrogen chloride was removed and not chlorine alone, the author studied the action of zinc on triphenylchlormethane dissolved in ethyl acetate, as this solvent has a marked effect on the removal of halogen atoms from organic compounds. The reaction took place readily, and hydrogen and hydrogen chloride were evolved. According to the view of Gomberg, the unsaturated compound unites directly with oxygen and is so converted into a peroxide of the structure $(C_6H_5)_3C—O—O—C(C_6H_5)_3$. According to the author, this compound could be formed only by the combined action of oxygen and water on the unsaturated hydrocarbon. A stream of dry air was drawn through a benzene solution of the unsaturated compound for twenty minutes and the peroxide was not precipitated. The author is of the opinion, therefore, that the action of metals on triphenylchlormethane consists in the removal of hydrogen chloride and not chlorine alone.

The Synthesis of Amines by the Use of Alkyl Salicylates. By Alfred Tingle. *Am. Chem. J.*, **25**, 144–155.—It has been previously shown by the author that when alkyl salicylates are boiled with an excess of aniline, the alkyl group is introduced into the aniline molecule, a secondary aniline being produced, and carbon dioxide and phenol are formed. It was also shown that when dry ammonia is passed into boiling methyl salicylate, dimethylamine is produced, but no phenol is formed. The work described in the present paper was undertaken to find out, if possible, the mechanism of the synthesis. Dry ammonia was passed into boiling methyl salicylate for twenty hours and the non-volatile products of the reaction were separated and identified. These were found to be salicylamide and polysalicylic nitrile, which was present in very small quantity. With the ethyl and isoamyl esters a reaction took place very slowly, but in neither case was there any evidence of the formation of an amine. The action of aniline on methyl benzoate was next studied to determine whether an analogous reaction took place in this case. The sole product of the reaction was benzanilide, no amine being produced. It was found, however, that the reaction took place in the reverse direction. Benzoic acid and dimethylaniline, when boiled together for nine hours, yielded a mixture from which methyl benzoate was isolated. The reactions involved in these syntheses can be expressed by the following equation:

$$R.COOR' + C_6H_5NH_2 \rightleftharpoons R.COOH + C_6H_5NHR'$$

The reaction is a reversible one and the end-products are determined by the velocities in the two directions and the stability of the acid set free from the ester. In the case of the salicylates the acid liberated is readily decomposed into carbon dioxide and phenol when the reaction takes place in the presence of aniline,

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but when ammonia is used, ammonium salicylate is formed, which is changed at the temperature of the reaction into salicylamide. When methyl salicylate and aniline in the molecular proportions of two to one, respectively, were boiled together for six hours the resulting basic oil consisted wholly of dimethyl aniline. To determine if the formation of substituted anilines in this reaction was dependent upon the fact that the acid set free from the ester was decomposed, the action of aniline on methyl *p*-hydroxybenzoate and the corresponding meta ester was studied. The meta compound gave the anilide and no substituted aniline, while the para compound gave phenol and methyl aniline or dimethyl aniline, according to the quantities of the substances used. Methyl *m*-hydroxybenzoate, prepared by Fischer's method, crystallizes in needles, which melt at 70°. The author explains the reactions by assuming that an intermediate addition-product of the ester and amine is first formed, and that this unstable compound breaks down into either a secondary amine and an acid or an alcohol and an anilide.

The Constitution of Benzene. By GEORGE M. RICHARDSON. *Am. Chem. J.*, **25**, 123–144.—The author discusses at some length the chemistry of benzene and its derivatives and has come to the conclusion that the formula of benzene, as put forward by Claus and modified by Loschmidt, is more in accord with the facts than is the centric formula. This conclusion has been reached by a study of the phenomena of substitution, reduction, and oxidation, and the effect of position of the substituting group upon the properties of a compound. A large number of apparently independent facts have been brought together and so grouped that interesting and important relationships have been brought to light. On account of its nature the paper can not be reviewed adequately in a brief space.

On the Action of Aromatic Sulphonchlorides on Urea. By IRA REMSEN AND W. W. GARNER. *Am. Chem. J.*, **25**, 173–190.—Some time ago Elander found that a compound of the formula $C_6H_5.SO.N_4H_5C_2O_2 + H_2O$ was formed when benzene sulphonchloride and urea reacted, at 100°, in the molecular proportion of one of the former to two of the latter. The authors have studied this condensation further, and have proved that the reaction-product is the benzene sulphonate of guanylurea. It is probable that in the reaction the sulphonchloride acts, in the first instance, as a dehydrating agent, thus causing the union of two molecules of urea with the elimination of water and the consequent formation of guanylurea. This liberated water converts a part of the sulphonchloride into the sulphonic acid, which, in turn, unites with the urea derivative to form a salt. The condensation-product was shown to be the benzenesulphonate of guanylurea by comparing it with a sample of the sulphonate pre-

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pared by bringing together in aqueous solution benzenesulphonic acid and guanylurea. When the sulphonate was heated with dilute hydrochloric acid at 180°, it was decomposed ; carbon dioxide, ammonium chloride, and the benzenesulphonate of guanidine were formed. Fuming nitric acid converted guanylurea benzenesulphonate into nitroguanidine and nitrobenzenesulphonic acid. Analogous condensation-products were obtained by heating urea with *o*- and *p*-toluenesulphonchlorides and *α*- and *β*-naphthalenesulphonchlorides.

On the Action of Aromatic Sulphonchlorides on Thiourea. By Ira Remsen and H. J. Turner. *Am. Chem. J.*, **25**, 190–202.—The results obtained in studying the action of aromatic sulphonchlorides on urea, an account of which is given in the preceding review, led to an investigation of the reaction between benzenesulphonchloride and thiourea. In this case a complicated reaction was found to take place. A part of the thiourea abstracts chlorine from the sulphonchloride and unites with the halogen to form dithiourea dichloride, $(SC.N_2H_4)_2.Cl_2$. The residues of the two molecules of the acid chloride are reduced by two molecures of thiourea with the consequent formation of benzene disulphoxide. The reaction proceeds as follows:

$$2C_6H_5SO_2 + SC.N_2H_4 = (C_6H_5SO)_2 + 2CNNH_2 + 2S + 2H_2O.$$

This disulphoxide was found to be identical with the phenyl benzenethiosulphonate of Otto. The reactions take place so smoothly that they furnish an excellent method for the preparation of the disulphoxide. *p*-Toluenesulphonchloride reacted analogously with thiourea. The disulphoxides were also prepared by the action of dithiourea dichloride on the potassium salts of benzene and toluenesulphinic acids.

On the Action of the Chlorides of Orthosulphobenzoic and of Paranitroorthosulphobenzoic Acids on Urea. By Willis B. Holmes. *Am. Chem. J.*, **25**, 202–216. When the symmetrical chloride of *o*-sulphobenzoic acid was heated at 100° with urea, a reaction set in, which was complete at the end of several days. From the reaction-product was isolated a small quantity of biuret and ammonium chloride and a good yield of a well-crystallized compound which melted at 266° and proved to be the ammonium salt of benzoylurea-*o*-sulphonic acid,

$$C_6H_4\begin{cases}COHNCONH_2\\SO_3NH_4\end{cases}.$$

On boiling with dilute hydrochloric acid this ammonium salt was hydrolyzed to the acid ammonium salt of *o*-sulphobenzoic acid ; when heated with a solution of potassium hydroxide the potassium salt of *o*-benzaminesulphonic acid was formed, and when treated in the cold with an excess of barium hydroxide the

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barium salt of benzoylurea-*o*-sulphonic acid was the result. From this barium salt the potassium, sodium lead, copper, and silver salts were prepared. When the unsymmetrical chloride of *o*-sulphobenzoic acid was heated with urea, the same reaction-products were obtained as with the symmetrical chloride, but the reaction took place more readily. A study of the condensation of urea with the chlorides of *p*-nitro-*o*-sulphobenzoic acid led to perfectly analogous results. Improved directions for preparing the acid chlorides used and a probable explanation of the reactions above described are given.

On Trivalent Carbon. By M. Gomberg. *Am. Chem. J.*, **25**, 317–334.—The author takes exception to the explanation of the action of zinc on triphenylchlormethane put forward by Norris (see review above) and describes experiments which were made to show that zinc removes chlorine alone from the halogen compound. When the ethyl acetate used as solvent during the reaction had been dried with great care over phosphorus pentoxide, the evolution of no hydrogen was observed and no free hydrochloric acid was found in solution. It was also discovered that when a stream of dry air was passed through a solution of the unsaturated compound for a day, the peroxide was precipitated. The author is of the opinion that the only explanation of the reactions is that put forward by him in an earlier paper, namely, that the metal withdraws the halogen from triphenylchlormethane and that an unsaturated radical of the formula $(C_6H_5)_3C-$ is formed in which the carbon is trivalent.

On Methyl Cyanide as a Catalytic Reagent; and a Criticism of J. U. Nef's Views on the Frankland, Wurtz, and Conrad Reactions. By Arthur Michael. *Am. Chem. J.*, **25**, 419–430.—It has been found that methyl cyanide has a marked influence on the action of sodium on alkyl halides. Propyl iodide, for example, which Schorlemmer found did not react with sodium at the boiling-point of ether, when treated with a few drops of acetonitrile, reacted vigorously with the metal. From 310 grams of the iodide a yield of 80 per cent. of the theory of hexane was obtained. The nitrile was found to have an accelerating effect on the action of sodium on allyl iodide, isopropyl iodide, trimethylene bromide, and benzyl chloride. The catalytic property of methyl cyanide is shared by ethyl and propyl cyanides, although, particularly in the case of the last substance, the inductive capacity appears to be less developed, and with the aromatic cyanides, benzonitrile and benzyl cyanide, no acceleration of the reaction was noticed. The author points out the important fact that zinc ethyl iodide may be used in place of zinc ethyl in many syntheses. The formation of ethyl malonic ester by heating a mixture of ethyl iodide and malonic ester with zinc was shown to take place as follows: the zinc ethyl iodide, which

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is first formed, reacts with the malonic ester and yields a metallic derivative, which, in turn, reacts with more ethyl iodide with the consequent formation of zinc iodide and ethyl malonic ester. Diethyl malonic ester accelerated the action between zinc and ethyl iodide and formed an addition product with the resulting zinc ethyl iodide. The author closes with a caustic criticism of the explanation by J. U. Nef, of the syntheses of Wurtz, Frankland, Conrad, and Daimler, and ridicules the elimination and addition theory which Nef has developed as a result of a great amount of experimental research.

On Thiourea-Amidines. By Henry L. Wheeler. *J. Am. Chem. Soc.*, **23**, 223–237.—In a former paper (*J. Am. Chem. Soc.*, **22**, 365) Wheeler and Sanders described compounds prepared by the action of certain amines on thiourea-imido esters and acyl-thiourea-imido esters, which were considered to be thiourea-amidines. Further study has shown that the reaction-products are thiourea derivatives. Examples of thiourea-amidines have been prepared by combining benzenylphenylamidine with phenyl mustard oil and with benzoylrhodanide.

Compounds of Methyl Sulphide with Halides of Metals. By Francis C. Phillips. *J. Am. Chem. Soc.*, **23**, 250–258.—When methyl sulphide is added to solutions of various inorganic chlorides colored precipitates are formed. The following compounds, prepared in this way, are described: $PdCl_2 2(CH_3)_2S$, $3HgCl_2 2(CH_3)_2S$, $CuCl(CH_3)_2S$, and $AuCl(CH_3)_2S$.

On the Action of Alkyl Thiocyanates and Alkyl Isothiocyanates with Thiol Acids. By Henry L. Wheeler and Henry F. Merriam. *J. Am. Chem. Soc.*, **23**, 283–299.—Thiocyanates react with thiol acids in at least two ways. Either a stable addition-product is formed, or hydrogen cyanide is evolved and a thiol ester results. The isothiocyanates react with thiol acids more energetically than do the thiocyanates. In this case the reaction takes place apparently in a quantitative manner as follows:

$$RNCS + HS.COC_6H_5 = RNH.COC_6H_5 + CS_2.$$

Not only the alkyl, but also the acyl isothiocyanates behave in this way. The difference in the behavior of the two forms of thiocyanates with thiol acids sharply distinguishes them from one another. The non-formation of carbon disulphide in this reaction may be taken as proof that the mustard oil form is not present. The authors tested a number of supposed derivatives of isothiocyanic acid and have come to the conclusion that neither isothiocyanacetic acid nor any of its derivatives have yet been prepared. Acyl imidodithiocarbonic esters were prepared by the action of alkyl iodides on the sodium salt of acetyl dithioethylcarbamate. These carbonic esters were converted into a new type of pseudo-

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thioureas by the action of ammonia and organic bases. The behavior of acyl dithiocarbamic esters with ammonia and organic bases was also studied.

BIOLOGICAL CHEMISTRY.

Root Tubercles in Water Culture. By H. A. Weber. *J. Am. Chem. Soc.*, **20**, 9–12.—The question of the connection between root tubercles and the fixation of atmospheric nitrogen has thus far been studied only in connection with sterilized soil or sand. The author describes an apparatus employed for the water-culture of root tubercles, which presents certain advantages over methods previously used.

Nitric Nitrogen Produced by the Pea. By J. L. Beeson. *J. Am. Chem. Soc.*, **20**, 793–795.—Field experiments carried out with peas indicate that peas planted with a crop would tend to increase the yield of that crop under certain conditions. This is considered to be due to the nitric nitrogen assimilated from the air in the soil in excess of that required by the growing pea plant itself.

On the Preparation of Nucleic Acids. By P. A. Levene. *J. Am. Chem. Soc.*, **22**, 329–331.—For the preparation of the nucleic acids from nucleo-proteid as well as from paranucleo-proteids the author proposes a method based on the treatment of the tissues with acetates at a low temperature, precipitation of the proteid material by picric acid, and final precipitation of the nucleic acid from the acetate solution by alcohol.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 9.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Department of Mining and Metallurgy at the McGill University, Montreal. BY CORRESPONDENT. *Eng. Min. J.*, 71, 514–516.—The paper describes with much detail the new mining and metallurgical laboratory, giving a plan of the same, and discusses in a general way the history of the department and its methods of instruction.

Stamp Milling of Free Gold Ores. BY D. HARMON. *Min. Sci. Press*, 82, 556–560.—The paper discusses, with illustrations, the practical details of milling gold ores; they are more of a mechanical than of a chemical nature.

Electro-Silvered Versus Plain Copper Plates. BY J. R. COOPER. *Eng. Min. J.*, 71, 331.—In the extraction of gold from its ores by means of the battery-amalgamating process, electro-silvered plates have replaced in most instances the plain amalgamated copper plates, as the latter become more or less tarnished with copper salts, which prevent amalgam or quicksilver from adhering. The author calls attention to the fact that all copper contains more or less cuprous oxide, and that, as this oxide does not combine with quicksilver, a plain copper plate can be only imperfectly amalgamated. Even if at first the whole plate is coated with quicksilver, this will break off from the oxidized parts and the latter be exposed to the action of water, oxygen, carbonic acid, etc.

Mackay's Amalgam Press. BY THE EDITOR. *Eng. Min. J.*, 71, 83–84.—The paper is an illustrated description of a piston-press worked by steam, air, or water. It removes in a better way than is possible by ordinary means the surplus quicksilver

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from amalgam, thus enriching the amalgam and reducing the amount to be retorted.

When to Begin Treatment of Cyanide Tailings. By H. M. Crowther. *Eng. Min. J.*, 70, 732.—The tailings coming from mills which leach gold ores with potassium cyanide always retain more or less gold. If rich enough, they are re-treated directly, if not they go to waste or are perhaps stored to be re-treated at a later date, when the cost of working will be lower on account of the cheapening of labor and materials. The author found that by simply rewashing tailings from three to twelve months old from the dumps of the Mercur mine, Utah, containing 13.2 per cent. water and assaying $1.05, he obtained an extraction of 53.3 per cent. of the gold. Tailings usually retain at least ¼ lb. of potassium cyanide and somewhat more free caustic alkali per ton. If care is taken to add to the last wash-water from one to several pounds of caustic alkali the tailings will retain sufficient alkali to protect the residual potassium cyanide and allow it to have its solvent effect upon the residue in the tailings, which are being slowly affected by the action of air, moisture, and warmth.

The Agitation Process for Cyaniding Slimes. By C. S. Hurter. *Eng. Min. J.*, 71, 82–83. **Discussion.** By J. F. Webb. *Ibid.*, 144.—The paper is an illustrated description of the manner in which the pneumatic cyanide process is carried out at the works of the Cochiti Gold Mining Co., near Bland, N. M. Low-grade slimes, of which ninety-six per cent. will pass a 100-mesh sieve, are treated at a cost of $1.00 a ton with an extraction of eighty per cent. The slimes are agitated (in 3 to 3½ ton charges) in tanks nine feet in diameter and five feet deep (holding six tons solution with 0.15 per cent. potassium cyanide) for twenty-four hours with steam and compressed air which pass into the solution through a number of perforated pipes placed along the bottom of the vat. About sixty pounds of lime are charged into a wire bucket suspended to reach below the surface of the solution. The lime not only neutralizes any acid reaction of the pulp, but also aids later in settling the slimes. After treatment the pulp is run from the agitating tanks into "wire" settling tanks, placed in series, from which the overflow is made to pass through upward-filtering tanks before it goes to the zinc boxes. From the settling tanks the slimes are sluiced out into decanting tanks and allowed to settle for from twelve to twenty-four hours; the clear solutions, drawn off through openings in the side, are mixed with the liquors from the "wire" settling tanks before they pass through the filtering tanks.

One man in a 10-hour shift can do the work of a 20-ton plant; for agitation one-tenth of one horse-power a day is required per ton of ore. The consumption of reagents per ton of ore is one

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pound potassium cyanide, twenty pounds lime, and one pound zinc. The cost of treatment is as follows :

Cyanide, 1 lb. at 31c	$0.31
Lime, 20 lbs., at $18 per ton	0.18
Zinc, 1 lb. at 12c	0.12
Tramming	0.04
Power, 0.1 H. P. at 40c	0.04
Labor, 0.05 day at $3.50	0.175
Extras, repairs, smelting, etc	0.135
Total cost per ton of pulp treated	$1.00

The Riecken Process for Treating Telluride and Sulphide Ores. By H. R. Cassel. *Eng. Min. J.*, 70, 664 ; 71, 47.—This process aims to extract coarse and fine gold from raw or roasted ores by means of a combination of amalgamation and lixiviation with potassium cyanide in a manner somewhat similar to that attempted in the electrochemical process of Pelatan-Clerici. The apparatus used consists of a horizontal stationary tank with stirring shaft having beaters. The tank, open at the top, has vertical ends, inclined sides, and a rounded bottom. The sides and bottom are lined with removable amalgamated copper plates, forming the negative pole ; the positive pole is stationary. A small pump, drawing its supply from a trap at the bottom of the tank, causes quicksilver to flow continuously over the amalgamated plates. The ore is charged with quicksilver and a dilute solution of potassium cyanide into the vat ; the coarse gold is amalgamated and the fine gold dissolved and electrically precipitated on the quicksilver cathode.

Pyritic Smelting and Hot Blast. By S. E. Bretherton. *Eng. Min. J.*, 70, 760–761.—The author, a strong advocate of pyritic smelting, claims that in comparison with lead smelting, pyritic smelting saves as high a percentage of gold and silver with a concentration of 8 to 15 tons of ore into 1 of matte with 50 to 60 per cent. of copper ; that it permits a higher degree of concentration in working ores with 1 to 2 per cent. copper ; and that it allows a larger percentage of zinc in the charge as well as a more silicious slag. The charges run by the author, using hot blast, contain 3 per cent. copper and over, 20 to 30 per cent. iron, 8 to 13 per cent. lime, not over 10 per cent. zinc, 10 per cent. alumina, 30 to 36 per cent. silica, 10 to 30 per cent. sulphur.

Pyritic Smelting and Hot Blast. By A. E. Bretherton. *Eng. Min. J.*, 71, 458.—The main point of interest in this paper is a dimensioned drawing of the author's blast-furnace and fore-hearth, with air-chamber and flues for superheating the blast by means of the waste heat of the fused matte and slag collecting in the fore-hearth.

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The Province of Pyritic Smelting. By H. Lang. *Eng. Min. J.*, 71, 589-590; 617-618.—Pyritic smelting may be defined as a matting blast-furnace smelting process in which parts of the metallic sulphides are oxidized, thereby giving a more concentrated product. The degree of concentration depends mainly on the proportion of silica in the charge. As the silica increases the matte-fall decreases, as does also the smelting power, because slags when acid run more slowly than when basic. Thus a furnace with a charge rich in pyrite, run to form a basic slag, will give much low-grade matte and put through large quantities with little fuel. At Tilt Cove, Newfoundland, 3 tons pyrite were concentrated into 1 ton of matte, the furnace running without any coke and with cold blast. At Mount Lyell, Tasmania, heavy pyritic ore with 3 per cent. copper is smelted with silicious flux to a matte containing over 20 per cent. copper, *i. e.*, a concentration of six into one. The matte is smelted pyritically with silicious flux (raising the tenor of copper to 50 per cent., *i. e.*, a concentration of 2½ tons into 1) when it is Bessemerized. A furnace with a charge containing 35 per cent. pyrite, which is run to form an acid slag, will give a concentration of eight into one and put through a considerable amount of ore, but it will require about 5 per cent. coke and a blast heated to 250° C. A furnace running a charge with a deficiency of sulphides, or with a slag that is very silicious, loses most of its pyritic character and requires, of course, much larger quantities of coke, from 10 to 20 per cent. In pyritic work two-thirds of the coke can be replaced by the use of hot-blast.

The Leaching of Copper Ores. By J. Ohly. *Min. Sci. Press*, 82, 51-61.—This paper is a partial review of the subject written for the general public. Some of the reactions said to take place in roasting previous to leaching are at least doubtful; thus sodium sulphate and cupric silicate, when subjected to an oxidizing roast, will hardly form sodium silicate and cupric sulphate.

Modern Leaching Processes. By J. Ohly. *Min. Sci. Press*, 82, 168-169.—The general character of this paper is similar to that of the preceding one.

Name Plates. By E. S. Sperry. *Al. World*, 7, 74-75.—Name plates, *i. e.*, plates bearing the names of manufacturers of machinery, are usually cast of bronze or of aluminum; brass is sometimes used, but its color is not so pleasing as that of bronze; iron plates are unsightly. In order to obtain the right color the composition of the bronze is somewhat limited. The two following mixtures, copper 90 per cent., tin 8 per cent., zinc 2 per cent., and copper 92 per cent., tin 3 per cent., and zinc 5 per cent., give satisfactory castings. An alloy of aluminum with 6 per cent. copper also works well. The paper gives some practical details about casting these alloys.

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Method of Making Alumina. By C. M. HALL. *Al. World*, 7, 75-76.—The new method of producing pure alumina consists in charging bauxite (calcined at a low heat if necessary), burnt lime, sodium carbonate, and water into a digester provided with a stirring mechanism and subjecting the mixture at a considerable pressure to an elevated temperature for from one to three hours. Insoluble carbonate and silicate and inert impurities of the bauxite, such as iron oxide, insoluble alumina, etc., will form a residue to be separated by filtration from the soluble sodium aluminate. From the latter, aluminum hydroxide is precipitated in the usual way by carbonic acid and filtered off; the filtrate, with its sodium carbonate, is concentrated by heating and used again with another charge.

Aluminum-Zinc Alloys. By J. W. RICHARDS. *Al. World*, 7, 153-154.—Alloys containing equal parts of zinc and aluminum or more zinc than aluminum have no specially valuable mechanical properties; the case is different when aluminum prevails over zinc. The alloy 2 parts aluminum to 1 part zinc, that is, with 33⅓ per cent. zinc, is remarkable. According to Durand (*Science*, *1897*, p. 396), its strength equals that of cast-iron; it melts at about 425° C., fills the joints of a mold perfectly, does not oxidize readily, and takes a fine finish; it is brittle, but resists corrosion well. The author adds to the above that while his first castings showed a breaking strain of 18,000 to 24,000 pounds per square inch with no perceptible elongation, he has no difficulty at present in securing a tensile strength of 40,000 pounds. Such a casting resembles a high-carbon steel; it, however, works well under tools and does not require any lubrication. Its high specific gravity of 3.8 shows that a great contraction has taken place in the formation (*viz.*, 17 per cent.), which suggests a cause for its great strength. The alloy, 3 parts aluminum to 1 part zinc, that is, with 25 per cent. zinc, is the one most commonly used. It is softer than the alloy with 33⅓ per cent. zinc, has a tensile strength of 35,000 pounds, and is less brittle; its specific gravity is 3.4, showing a contraction of 14 per cent. With alloys containing less than 25 per cent. zinc, the strength and hardness decrease quickly; an alloy with 10 per cent. and less zinc can be forged, rolled, and drawn.

The Dominion Iron and Steel Co., Limited. By C. KIRCHHOFF. *Iron Age*, 66, 18-22.—The paper is an illustrated description of the new iron and steel works in the process of erection near Sydney, Cape Breton. It will consist of four blast-furnaces (85 feet high, 20-foot bosh), ten 50-ton open-hearth furnaces, a 35-ton blooming mill, a coal-washing plant, and 400 Otto-Hoffmann by-product coke-ovens. The ore mined on Great Bed Island, Newfoundland, contains H_2O, 1.50–2.50; Fe, 54.43–57.84; SiO_2, 9.34–13.00; P, 0.744–0.835; S, 0.05–0.03. Good limestone is

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quarried near the works. The following analyses are given as being characteristic of the unwashed and washed coal of the leading mines of the Dominion Coal Co., and of the coke produced from the washed coal.

GENERAL COAL ANALYSIS.

Raw coal.	Reserve mine. Per cent.	Caledonia mine. Per cent.	Dominion mine. Per cent.
Moisture	1.45	1.54	1.21
Volatile matter	32.45	30.86	31.89
Fixed carbon	60.45	62.91	61.49
Sulphur	1.64	1.50	1.56
Ash	5.65	4.69	5.41
Washed coal.			
Moisture	1.01	1.08	0.84
Volatile matter	32.99	33.92	37.86
Fixed carbon	62.21	61.69	62.60
Sulphur	1.11	1.07	1.17
Ash	3.79	3.31	4.50
Retort coke.			
Sulphur	0.91	0.78	1.01
Ash	6.07	5.38	6.24

Heat and Power from the Waste Gases of Blast-Furnaces. BY F. W. GORDON. *Iron Age*, **66**, 1–6.—The paper shows which part of the total heat generated by an iron blast-furnace is required by the furnace itself, and which is available for other purposes. The calculations are based on data of one of the South Chicago blast-furnaces published by the author in 1885 (*Trans. Am. Inst. Min. Eng.*, 14, 362).

Cast-Iron Car-Wheels. BY G. W. BEEBE. *Iron Trade Rev.*, **33**, 16-17.—The author calls attention to the small amount of damage done by the failures of cast-iron car-wheels, when it is considered that 10,269,924 such wheels are in use at present. He attributes this fact to the close inspection and to the thermal and drop tests exacted by the railroad companies, both of which are described in detail with illustrations. The thermal test requires that a sample wheel of a melt when cast under specified conditions shall not crack upon cooling; the drop test requires that the wheel, supported in a certain definite way, shall stand a number of blows from a hammer weighing 100 to 140 pounds and lifted 7 to 12 feet. The subjoined table gives the chemical composition of wheels that withstood the physical tests and that did not:

	Wheels that failed in thermal test.		Wheels that stood thermal test.		Wheels that failed under 50 blows, Barr drop.		Wheels that stood 50 blows and over, Barr drop.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Total carbon	3.91	3.03	3.90	3.38	3.87	3.42	3.93	3.49
Graphitic carbon	3.02	2.92	2.98	2.71	3.19	2.90	3.02	2.90
Combined carbon	0.89	0.71	0.92	0.67	0.68	0.52	0.91	0.59
Sulphur	0.090	0.042	0.60	0.080	0.080	0.020	0.070	0.05
Manganese	0.60	0.49	0.58	0.48	0.62	0.40	0.72	0.47
Silicon	0.82	0.50	0.91	0.50	0.97	0.67	1.10	0.68
Phosphorus	0.48	0.39	0.52	0.26	0.58	0.30	0.53	0.28

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The Tropenas Process for Steel Castings. By The Editor. *Foundry*, 17, 237; *Eng. Min. J.*, 70, 761.—The paper contains a brief description of the Tropenas process with illustrations of converter and of castings.

Influence of Copper in Retarding Corrosion of Soft Steel and Wrought Iron. By F. H. Williams. *Eng. Soc. Western Pa.*, 26, 231, through *Iron Age*, 66, 16.—The experiments described were carried out in order to show what effects small additions of copper would have in retarding the corrosive effect of moisture on soft steel and wrought iron. For this purpose the specimens were cut and filed to the same dimensions, weighed, suspended on a frame, dipped together into water, and then left to hang in the air until dry. This treatment was repeated several times a day for a month, until the oxide-scale formed showed a tendency to peel off. The specimens were freed from oxide and then weighed. In the table below are given the percentage losses:

Loss from Atmospheric Corrosion.

	Loss in weight. Per cent.
A—Soft Bessemer steel	1.85
B—Soft Bessemer steel with 0.078 copper	0.89
C—Soft Bessemer steel with 0.145 copper	0.75
D—Soft Bessemer steel with 0.263 copper	0.74

Steel and Wrought Iron.

	Loss in weight. Per cent.
Soft Bessemer steel	1.65
Wrought iron, sample 1	0.76
Wrought iron, sample 2	0.80
Wrought iron, sample 3	0.87
Wrought iron, sample 4 (containing 0.393 per cent. copper)	0.53

They show that both soft Bessemer steel and wrought iron resist corrosion much better when they contain some copper than when they do not.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. Crosby, Reviewer.

On the Constitution of Barytocelestites. By C. W. Volney. *J. Am. Chem. Soc.*, 21, 386–388.—Although previous work had discredited the existence of a true barium-strontium sulphate, showing only barites containing a trace of strontium or celestites containing a trace of barium, the author finds this mineral from eastern Ontario to yield: $BaSO_4$, 30.850, and $SrSO_4$, 70.010. A previous analysis by the author had given: $BaSO_4$, 39.850, and

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$SrSO_4$, 58.200. These results correspond very closely to the formulas $(BaSr_2)(SO_4)_2$ and $(BaSr_3)(SO_4)_4$. These two types of barytocelestites have distinct habits of crystallization which remain to be investigated.

Analysis of Emery from Virginia. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 212–213.—The emery occurs in a heavy ledge near Whittle's, on the line of the Southern Railroad, in Pittsylvania County. It is described as a black, crystalline mass, magnetic, polar, with specific gravity 4.205, and hardness 8. The analysis shows: alumina, 56.74; ferric oxide, 15.50; ferrous oxide, 20.77; silica, 0.68; titanic oxide, 1.86; soda, 3.95. The ferrous oxide, in excess of that required to form magnetite, is supposed to be present as hercynite, $FeAl_2O_4$; and the soda is considered to take the place of ferrous oxide in forming additional hercynite, thus greatly reducing the amount of alumina which can exist as corundum. The large amount of hercynite reduces the erosive power and makes the mixture of no value as emery.

Examination of a Sandstone from Augusta County, Virginia. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 216–217.—This sandstone is a disintegrated quartzite, occurring in the vicinity of Basic City, and found to be valuable for ballast and road metal. The analysis shows large proportions of alumina and alkalies, indicating partially kaolinized feldspar, which is regarded as explaining the packing of the material in use.

Analysis of Smithsonite from Arkansas. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 218–219.—The smithsonite from the Morning Star Mine, in Searcy County, is the usual botryoidal variety, and encloses layers of zinc blende from which, probably, it has been derived. The analysis shows it to be nearly pure, but with a little cadmium, copper and iron replacing zinc.

On the Interpretation of Mineral Analyses: a Criticism of Recent Articles on the Constitution of Tourmaline. By S. L. Penfield. *Am. J. Sci.*, **160**, 19–32.

C. H. Warren, Reviewer.

Nitrates in Cave Earths. By Henry W. Nichols. *J. Geol.*, **9**, 236–243.—This is, in the main, a criticism of the theory advanced by Hess (*J. Geol.*, **7**, 2) that the nitrates of cave earths are not derived to any extent from bat guano, as has been formerly supposed, but from the soil above by a leaching process followed by a deposition of the salts on evaporation. The chief objections raised by Hess to the old theory may be briefly summarized as follows: 1. Bats do not penetrate far into caves, which makes it difficult to account for the presence of salts derived from guano and their uniform distribution in the caves. 2.

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Cave earths contain little or no organic matter. 3. While the total phosphates in the guano and underlying earth are about equal, the soluble phosphates are much less in the earth. In criticizing these objections it is shown that bats do penetrate into remote parts of the caves, that in some instances cave earths do contain organic matter, and that the lack of soluble phosphates in the earth is due to a simple reversion of the soluble to an insoluble form. Among other things to which attention is called is the presence of carbonates in the drip waters of the cave and their absence in the cave earths, a fact which Hess' theory does not account for. It is thought that the amounts of phosphates and nitrates taken into solution from the soil are too small to account for the amounts found in the earths and that the considerable quantities of soluble salts in the bat guano furnish a more probable source of supply. The author therefore concludes that the old theory agrees with the facts better than the new.

Mohawkite. By Joseph W. Richards. *Am. J. Sci.*, **161**, 457–458.—Under the name mohawkite a mineral was described by Ledoux (*Eng. Min. J.*, Apr. 7, 1900) to which he assigned the formula $(Cu,Ni,Co)_4As$. Later the correctness of his work was called into question by Koenig, who appropriated the name mohawkite for a mineral which he described (*Am. J. Sci.*, Dec., 1900) as having the composition $(Cu,Ni,Co)_3As$. A new analysis is reported in the present paper, confirming the correctness of Ledoux's work and proving the existence of a molecule $(Cu,Ni,Co)_4As$. The name Ledouxite is proposed as a name for the latter.

On the Origin of the Phenocrysts in the Porphyritic Granites of Georgia. By Thomas L. Watson. *J. Geol.*, **9**, 97–122.—A detailed petrographical study is given of the porphyritic granites of Georgia, within the Piedmont Plateau. The different areas are taken up according to their geographical distribution. The following facts given by the author concerning these rocks are believed to indicate that the phenocrysts (orthoclase) have been formed in place and are not of intratelluric origin: 1. The absence of a definite arrangement or orientation among the phenocrysts. 2. Absence of the phenocrysts from the border zones of the granite masses and a gradation peripherally from an interior porphyritic facies into an even-granular granite of coarse texture and of the same mineral and chemical composition. 3. The absence of any evidence of magmatic resorption or corrosion of the phenocrysts. 4. The absence of any flow structure. 5. The abundant inclusions of all the ground mass constituents, a feature very characteristic of these porphyritic granites. A table of the chemical analyses of these rocks accompanies the article.

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Mineralogical Notes. By C. H. WARREN. *Am. J. Sci.*, 161, 369–373.—The following minerals are described: Anorthite crystals, occurring as a contact mineral in the limestone at Franklin Furnace, N. J.; soda orthoclase crystals of peculiar habit from a phonolite dike, Cripple Creek, Colo.; iron wolframite crystals from South Dakota; pseudomorphs of wolframite after scheelite from Trumball, Conn.

Studies for Students. By O. C. FARRINGTON. *J. Geol.*, 9, 51–66; 174–190.—This is a study of meteorites in regard to their chemical and mineralogical composition, their petrographical characteristics, their terrestrial analogies, and to some of the theories relating to their origin.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 10.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

Contribution to the Chemistry of Rhubarb. BY CARL G. HUNKEL. *Pharm. Archives*, 3, 201–216.—A study of some of the characteristic constituents of rhubarb, made especially with a view to determining the nature of the cathartic principle, the so-called cathartic acid.

A New Indicator for Use in Determining Total Acidity of Wines. BY E. G. RUNYAN. *J. Am. Chem. Soc.*, 23, 402–405.—The indicator is prepared as follows: 3.1 grams of corallin are dissolved in 150 cc. of 90 per cent. alcohol, neutralized and mixed with 0.5 gram of malachite green dissolved in 50 cc. of alcohol. The color is purple with alkalies and green with acids. In using the indicator, 10 drops of it are added to 10 cc. of the wine, diluted to 300 cc. and boiled as usual, an excess of decinormal sodium hydroxide is added, and the excess of alkali titrated with decinormal acid.

The Detection of Methyl Alcohol in Presence of Ethyl Alcohol. BY ALBERT B. PRESCOTT. *Pharm. Archives*, 4, 86–90.—In the method proposed the alcohols are first converted into aldehydes by oxidation with a red-hot copper spiral. The acetic aldehyde is then oxidized by hydrogen peroxide in excess, the excess being removed by sodium thiosulphate. The formaldehyde is finally tested for by the well-known Jorissen test, with phloroglucin in alkaline solution. The presence of one part of methyl alcohol in 20 parts of ethyl alcohol is shown by the test and ten or twelve minutes is required for its execution.

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The Lloyd Reaction for Morphine. By JOSEPH L. MAYER. *Am. J. Pharm.*, 73, 353–355.—The author has made experiments with twenty of the more common alkaloids and finds that only three, heroin, morphine, and veratrine, show the "Lloyd" reaction, *viz.*, the gradual appearance of a violet-blue color when mixed with concentrated sulphuric acid in the presence of hydrastine. Of the three, veratrine is the only one which gives a cherry-red color with cold concentrated sulphuric acid. The other two are distinguished by nitric acid, with which morphine gives an orange-red color and heroin a yellow color.

On the Estimation of Urea in Urine. By J. H. LONG. *J. Am. Chem. Soc.*, 23, 632–638.—The chief source of error in estimating urea in urine by the Liebig method of titration with standard mercuric nitrate is the combination of a portion of the mercury solution with ammonia, uric acid, and creatinin. The author finds that the average correction to be made in 20 cc. of fresh urine (10 cc. urine and 10 cc. water) is 2 cc. of the mercuric solution. In older urine the effect of the ammonia formed by decomposition of the urea becomes too great to be easily corrected.

On the Determination of Formaldehyde. By A. G. CRAIG. *J. Am. Chem. Soc.*, 23, 638–643.—Preference is given to the Legler method, in which the formaldehyde is allowed to stand with excess of normal ammonia, the excess being titrated with standard acid and litmus. The author considers it best, however, to place the formaldehyde and ammonia in a bottle which can be tightly closed and heated in a boiling water-bath for an hour. The titration is made with normal sulphuric acid and methyl orange to the first indication of a color change. A blank determination is necessary, and in any series of results the higher ones are likely to be the better.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

The Rate of Nitrification of Some Fertilizers. By W. A. WITHERS AND G. S. FRAPS. *J. Am. Chem. Soc.*, 23, 318–326.—The order of nitrification in the soil used was, dried blood (greatest), dried fish, tankage, bat guano, bone, ammonium sulphate. This is, in general, the order of availability as shown by vegetation tests and digestion in potassium permanganate. Nitrification was greatly accelerated in the presence of calcium carbonate. The low rate of nitrification of ammonium sulphate is probably due to the selective action of the nitrifying organisms.

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

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GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Eighth Annual Report of the Committee on Atomic Weights. Determinations Published in 1900. BY F. W. CLARKE. *J. Am. Chem Soc.*, **23**, 90–95.—The average values are given below. For comparison those adopted by the author in his previous report are appended in parentheses. All values are referred to oxygen taken as 16.000. The wide divergence of the two values for krypton is unexplained.

Nitrogen, Dean	14.031	(14.04)
Calcium, Herzfeld (in 1897)	39.975	(40.1)
Iron, Richards and Baxter	55.89	(56.0)
Gadolinium, Benedicks	156.38	(157.0)
Thorium, Urbain	233.5	(232.6)
Yttrium, Muthmann and Böhm	88.97	(89.0)
Samarium, Demarçay	147.6	(150.3)
Krypton, Ladenburg and Krügel	58.74	.....
Krypton, Ramsay and Travers	81.76	.....
Helium, Ramsay and Travers	3.96	.....
Neon, Ramsay and Travers	19.94	.....
Argon, Ramsay and Travers	39.96	.....
Xenon, Ramsay and Travers	128.00	.....

A Table of Atomic Weights of Seventy-Seven Elements. BY THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, **36**, 544-545.—The only important changes in the table since last year (see *this Rev.*, **6**, 144) are the assignment of the value 238.5, instead of 240, to uranium, on the basis of work not yet published, done in the author's laboratory, and the insertion of the new elements, neon, krypton and xenon, with atomic weights 19.94, 81.7, and 128 respectively.

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International Atomic Weights. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, **36**, 171–176; *Am. Chem. J.*, **24**, 377–383.—The author reports that the International Committee on Atomic Weights favor unanimously the appointment of a smaller committee to make a yearly revision, and approves by votes of about 40 to 8 the adoption of 16 parts of oxygen as the standard, and the retention of so many decimal places that the last figure is certain within half a unit. The author regards this last decision as unfortunate: he points out that it may introduce a very serious error (¼ per cent.) in some of the low atomic weights, one several times greater than exists in the determinations of them, and shows that it is quite irrational even from the standpoint of "common use," where a certain *percentage* accuracy (say 0.1 per cent.) is all that is ordinarily wanted. Therefore, if, as contended by the majority, adaptability to common use should be the guiding principle, only so many decimals should be retained as to secure, whenever possible, a certain percentage accuracy in the atomic weight value. To these objections the reviewer desires to add two others: first, that the refusal of the committee to recognize the gradual advances in accuracy which may be made tends to discourage the execution of exact atomic weight determinations; and second, that the deliberate disregard in this case of the scientific principles governing significant figures will make it more difficult than ever to secure proper recognition of those principles by chemical students and investigators.

The Standard of Atomic Weights. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, **37**, 177–181.—Besides emphasizing the familiar fact that oxygen has served as the experimental standard of reference in the great majority of cases, the author contends that the argument that the hydrogen standard has pedagogical advantages is illusory, for the student usually learns by heart the old rule, "the molecular weight equals twice the specific gravity," without understanding it, while if densities are referred to oxygen and the corresponding factor 32 is employed, the reason for the relationship is more apparent. In closing, the author urges that, whatever one's personal opinion may be, the decision of the International Committee be respected.

The Atomic Weight of Antimony. By G. CLAUSEN FRIEND AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 502–505.—Potassium antimonyl tartrate, purified by ten recrystallizations, was heated to dull redness first in hydrochloric acid gas, next in oxygen, and then again in hydrochloric acid gas; the carbon was filtered off after dissolving in water, the solution evaporated, and the residual potassium chloride weighed. The mean of eight determinations gives 120.353 as the atomic weight of antimony (oxygen = 16.00).

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On the Periodic System and the Properties of Inorganic Compounds. II. Gradations in the Properties of Alums. By JAMES LOCKE. *Am. Chem. J.*, **26**, 166–185.—The author has determined the melting-point, and solubility in water at 25° (in a few cases also at 30°, 35°, and 40°), of many of the alums containing sodium, potassium, rubidium, cesium, thallium, or ammonium as the univalent metal, and aluminum, vanadium, chromium, iron, cobalt, or indium as the trivalent metal. He has also calculated their molecular volumes. The solubilities of the alums of any one trivalent metal decrease with the nature of the univalent metal in the order, sodium (atomic weight, 23), potassium (39), or ammonium (18), thallium (204), rubidium (85), cesium (133). Those of the alums of any one univalent metal decrease in the order, iron (atomic weight, 56), vanadium (51), chromium (52), aluminum (27). The melting-points increase in the same order in which the solubilities decrease, iron being preceded by indium (atomic weight, 114) and cobalt (59), two additional trivalent elements whose alums were investigated. The extent to which these two properties of the alums are a progressively varying function of the atomic weight will be seen by comparing the order given above with that of the atomic weights. In the case of the univalent metals, thallium, the only element belonging to a distinct group of the periodic system, forms a marked exception. In the case of the trivalent metals, while there seems to be a tendency to conformity with the principle, it is by no means a pronounced one. This becomes still more evident when one considers, in addition to the mere order of the elements, the fact that the differences between the properties of the aluminum and chromium alums are small, while those between the properties of the chromium and vanadium alums are very large.

The Effect of Temperature, of Colloidal Ferric Hydrate, and of a Magnetic Field on the Hydrolysis of Ferric Chloride. By H. M. GOODWIN AND FREDERICK W. GROVER. *Phys. Rev.*, **11**, 193–214.—A study of the rate of the hydrolysis at 0°, 15.5°, and 25° shows that lowering of temperature diminishes very greatly the rate of formation of the colloidal hydroxide and increases the initial lag of the reaction (see *this Rev.*, **3**, 22). The addition of colloidal hydroxide at the start entirely destroys this lag, and accelerates the reaction nearly in proportion to the amount added. This confirms the explanation previously given of the lag and remarkable acceleration of the reaction when once started, according to which the rate of formation of the colloidal hydroxide is dependent on the presence of some colloid particles which can serve as nuclei for the further development of the colloid. It is also shown that the rate of the hydrolysis is not appreciably affected by a magnetic field of 2000 lines per square centimeter.

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A Spectrophotometric Study of the Hydrolysis of Dilute Ferric Chloride Solutions. By B. E. Moore. *Phys. Rev.*, **12**, 151–176.—Measurements were made with a Brace spectrophotometer of the light-absorption caused by freshly prepared dilute ferric chloride solutions, of its change with the time, and of its limiting value. The absorption can be regarded as an approximate measure of the amount of colloidal ferric hydroxide, for the other molecules and ions present are much more transparent. The results are in general accord with those previously obtained by Goodwin (*this Rev.*, **3**, 22 and preceding review) by the conductivity method. Namely, in very dilute solutions (0.0003 molar) the hydrolysis or colloid formation takes place with great rapidity, amounting to 50 per cent. in ten minutes, while at somewhat higher concentrations (0.0016–0.0024 molar) there is an initial period of inaction, followed by a rapidly increasing rate of hydrolysis. The solutions all hydrolyzed, however, considerably more rapidly than the corresponding ones of Goodwin. In 0.0003–0.0012 molar solutions the hydrolysis ultimately becomes complete, but stops at 80–87 per cent. in a 0.0012 molar solution.

On the Freezing-Points of Aqueous Solutions of Non-Electrolytes, II. By E. H. Loomis. *Phys. Rev.*, **12**, 220–239.—After discussing the variation in the zero-point of his thermometer, the author gives the results of further freezing-point determinations (see *this Rev.*, **6**, 142). The molecular lowerings calculated for one mol in a *liter* of *solution* are as follows:

	Molar concentration.				
Solute.	0.01.	0.02.	0.05.	0.10.	0.20.
Milk sugar.....	1.86	1.86	1.89	1.91	1.96
Maltose.....	1.93	1.89	1.89	1.92	1.97
Levulose.....	1.86	1.88	1.88	1.89	1.92
Dulcite	1.85	1.88	1.86	1.88	...
Acetamide	1.83	1.81	1.83	1.84	1.84
Salicine.....	1.83	1.87	1.87	1.87	...

All these substances except acetamide and perhaps maltose, like most of those previously studied, give the limiting value 1.86 as the dilution increases. The value calculated by van't Hoff's equation is also 1.86, if 79.3 be assumed as the heat of fusion of ice. With increasing concentration the values increase by a few per cent. in most cases; however, more nearly constant results are obtained if the molecular lowerings are calculated for one mol of solute in 1000 grams of solvent.

The Conductivities of Some Double Salts as Compared with the Conductivities of Mixtures of Their Constituents. By Charles F. Lindsay. *Am. Chem. J.*, **25**, 62–69.—The author claims to have found that the conductivities of solutions prepared by dissolving in water the three crystallized double salts, potassium cadmium chloride, potassium nickel sulphate, and ammo-

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nium magnesium sulphate, are less in ¼ to ⅛ molar solution by 1.3, 1.2, and 2.4 per cent., respectively, than the conductivities of solutions prepared by mixing the corresponding quantities of accurately analyzed solutions of the two constituents. The experiments were made in the same way in every respect with the two kinds of solutions, and the analyses of both are said to have been certainly accurate to 0.1 per cent. It is unfortunate, in an investigation of this kind, the value of which depends wholly on the exactness of the results, that the analytical data were not communicated. Moreover, no statement is made as to the time that elapsed between the preparation of the solutions and the measurement of their conductivities. The author also found, when a solution of the mixed constituents was evaporated to dryness and the residue redissolved, that the conductivity was less than before.

Contribution to the Study of Aqueous Solutions of Double Salts. IV. Iodides, Cyanides, Nitrates, and Sulphates. By HARRY C. JONES AND B. PALMER CALDWELL. *Am. Chem. J.*, **25**, 349–390.—In continuation of earlier researches (*this Rev.*, **6**, 1) the electrical conductivities of aqueous solutions of many double salts, at concentrations varying from molar up to a very high dilution, were measured and compared with the sums of the conductivities of the separate components of the salts, which were in most cases measured by the authors, but were in some cases derived from the work of other investigators. The percentage difference between the sum of the conductivities of the separate components and the conductivity of the double salt, in 0.1 normal solution, was found to be 23 per cent. in the cases of potassium cadmium iodide, strontium cadmium iodide, and potassium mercury cyanide, showing the existence in solution of a considerable quantity of the double salts. In the cases of the double sulphates of ammonium and magnesium, copper, ferrous iron, cadmium, or nickel, and of potassium nickel sulphate, at the same concentration, the differences were 11 to 14 per cent., again indicating, though much less conclusively, the existence of the double salts in solution. In the cases of the double nitrates of ammonium and neodymium, or praseodymium, the differences were very small (1.4–5.1 per cent.). The authors have also confirmed the results of Lindsay (see preceding review) with ammonium magnesium sulphate, and have investigated ammonium cadmium sulphate in the same direction with similar results. They have also studied the freezing-point lowering caused by some of the above-mentioned double salts and their components separately. The sum of the molecular lowerings of the components is greater than the molecular lowering of the double salt in 0.2–0.25 molar solution by 4.77° in the case of potassium mercuric cyanide, 0.47° in that of ammonium cadmium sulphate, and —0.30° in that of ammo-

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nium praseodymium nitrate. Thus, about 2.5 (4.77 ÷ 1.86) molecules disappear when 2KCN and $Hg(CN)_2$ are brought together, which corresponds well with the formation of the complex salt $K_2Hg(CN)_4$ if allowance is made for its degree of dissociation, which is probably less than that of the potassium cyanide. The differences in the other two cases are not large enough to prove the formation of a complex salt. Potassium cadmium iodide, cadmium sulphate, praseodymium nitrate, and ammonium praseodymium nitrate exhibit a minimum molecular lowering at not far from 0.2 molar concentration (see *this Rev.*, **6**, 2).

A Modification of the Usual Method of Determining Transference Numbers, and an Investigation of the Influence of the Concentration on Their Values in the Case of Some Triionic Salts. By ARTHUR A. NOYES. *J. Am. Chem. Soc.*, **23**, 37–57; *Phys. Rev.*, **12**, 14–42.—The modification consists only in adding, during the electrolysis, to the portions around the electrodes weighed quantities of acid and alkali solutions respectively of such a strength as to keep both the composition and concentration of the solution nearly constant. This enables, however, the electrolysis to be carried on much longer, thereby greatly increasing the accuracy of the results. By this method the transference numbers of potassium sulphate, barium nitrate, and barium chloride were determined in 0.2 and 0.04 normal solution. Those of the first two salts were found to differ only very slightly at the two concentrations, showing that the intermediate ions KSO_4' and $BaNO_3^{\cdot}$ do not exist in appreciable quantity. The transference number of barium chloride was found to increase greatly with increasing dilution, indicating the presence of complex ions like $BaCl_3'$ or $BaCl_4''$.

Studies on Solutions of Tin Salts. I. Electrical Conductivity of Solutions of Stannous Chloride and Hydrochloric Acid. II. The Oxidation of Solutions of Stannous Chloride by Means of Free Oxygen. III. The Course and Kinetics of the Reaction between Stannous Chloride and Oxygen. By S. W. YOUNG. *J. Am. Chem. Soc.*, **23**, 21–36, 119–147, 450–460.—I. The addition of stannous chloride is found, both at 25° and at 0°, to cause an increase in the conductivity of hydrochloric acid solutions when these are dilute (0.25–0.5 normal), but a decrease (of 3.6–4.7 per cent. for one equivalent of salt added per liter) when the acid solutions are concentrated (1- to 4-fold normal). In the latter solutions the absolute decrease of conductivity is nearly proportional both to the concentration of the ions of the hydrochloric acid and to that of the added stannous chloride; it seems to the reviewer that this fact, which is not sufficiently emphasized by the author, indicates that $SnCl_3'$ ions (corresponding to the complex acid $HSnCl_3$) are the main product of the action in the con-

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centrated solutions; the author, however, considers it probable that there are two complex acids present, such as $HSnCl_3$ and H_2SnCl_4, and that the one predominates in the diluter, the other in the stronger, solutions. The increase of conductivity in the dilute acid solutions may well be due to hydrolysis, as the author suggests. The absolute decrease in conductivity caused by stannous chloride was found to be always less when the hydrochloric acid was replaced in part by potassium chloride, but the percentage decrease was greater when large amounts of potassium chloride were used. In one experiment made with potassium iodide (instead of chloride) a much greater decrease of conductivity occurred, indicating that the iodine acid ($HSnI_3$) is more stable.

II. The apparatus is first described which was used for shaking solutions of stannous chloride containing hydrochloric acid, with oxygen under constant (atmospheric) pressure, and measuring the amount of gas absorbed as the reactions progressed. As preliminary experiments did not yield satisfactory first-order constants and showed that the reaction was exceedingly sensitive to accidental catalytic agencies, such as tobacco smoke and contact with rubber, an investigation was first made of the effect of various catalyzers. It was found that brucine, morphine, nicotine, aniline, and potassium cyanide greatly retarded the reaction, and that rubber powder, sulphur, stannous sulphide, iron and copper salts, and alcohol accelerated it.

III. Stannous chloride solutions were oxidized rapidly by five different agents, and the increase in the conductivity of the resulting solution with time determined. In every case this was found to be considerable, indicating that stannic chloride is the first product of the oxidation and that this then slowly hydrolyzes. In the last part of the paper the mass-action equations are formulated which should express the velocity of a reaction, such as this appears to be, in which a substance (the hydrochloric acid) consumed by it is regenerated by a secondary reaction.

Catalysis in Concentrated Solutions. By J. M. Crafts. *J. Am. Chem. Soc.*, **23**, 236–249.—Metaxylenesulphonic acid was heated in sealed tubes, at 100°, with hydrochloric acid solutions containing from 10–38 per cent. of the gas, the rate of decomposition being determined by cooling the tube and measuring in a calibrated part of it the layer of xylene which separated. The velocity-constants are found to increase enormously with increasing concentration of the hydrochloric acid, for example, 35-fold, when the concentration is increased from 19 to 38 per cent., and nearly so as to form a geometrical progression when the corresponding changes in the acid concentrations form an arithmetical progression, thus recalling the effect of temperature on the rate of reactions, or the increase in the partial pressure of hydrochloric acid gas from its own solutions (see *this Rev.*, 4, 57). The last-men-

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tioned parallelism seems to the reviewer especially significant, since the partial pressure of the vapor is an approximate measure of the (anhydrous and undissociated) HCl molecules in the solution. Experiments also showed that the addition of zinc chloride or sulphuric acid to the hydrochloric acid solution of the sulphonic acid greatly increased the rate of its decomposition; and the author suggests that the course of the reaction is perhaps to be explained by the hypothesis that it is only when the sulphonic acid molecules have been dehydrated that they are susceptible to hydrolysis. Fifty per cent. sulphuric acid was found to cause nearly as rapid a rate of decomposition as 25 per cent. hydrochloric acid, but, remarkably enough, nitric acid of a corresponding concentration causes a scarcely appreciable hydrolysis. A single experiment with the sulphonic acid of pseudocumene shows that it hydrolyzes somewhat more rapidly than that of metaxylene.

The Reaction between Chloroform and Potassium Hydroxide. By A. P. SAUNDERS. *J. Phys. Chem.*, 4, 660–674.—Six series of experiments were made on the velocity of the reaction mentioned in the title. Though the results are very irregular, they indicate that the reaction is one of the second, not one of the fourth, order; and, therefore, that it proceeds in successive stages.

On the Expansion of Certain Metals at High Temperatures. By LUDWIG HOLBORN AND ARTHUR L. DAY. *Am. J. Sci.*, 161, 374–390.—The linear expansion of bars of platinum, palladium, platinum-iridium, silver, nickel, constantan, wrought iron, and steel was measured between 0° and 750° or 1000° for each 250° (or 125°) interval.

On the Spectrum of the More Volatile Gases of Atmospheric Air Which Are Not Condensed at the Temperature of Liquid Hydrogen. By S. D. LIVEING AND J. DEWAR. *Am. J. Sci.*, 161, 154–161.—Besides communicating the experimental material relating to the subject named in the title, the authors state that they found that the gases referred to contained 43 per cent. of hydrogen, thus proving its existence in sensible proportion in the atmosphere.

Boiling-point of Liquid Hydrogen, Determined by Hydrogen and Helium Gas Thermometers. By JAMES DEWAR. *Am. J. Sci.*, 161, 291–301.—The boiling-point of hydrogen was previously determined only by a resistance-thermometer, which yielded the value —238.4°. In this result was involved the validity of an empirical law not tested for such low temperatures. The author has now determined it by measuring the pressure of hydrogen and of helium kept at constant volume, and finds it to be —252.5° or 20.5° absolute. By the same method that of oxygen is found to be —182.5°, in agreement with previous determinations.

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The Nadir of Temperature and Allied Problems. By JAMES DEWAR. *Am. J. Sci.*, **162**, 168–172.—This article, which is an abstract by the author of a lecture given by him before the Royal Society, contains many new and interesting results. The melting-point of solid hydrogen is 16° absolute by the helium thermometer, 16.7° by the hydrogen thermometer. The lowest temperature yet measured (that obtained by the use of solid hydrogen) is 14.5°. The heat of vaporization of liquid hydrogen is about 200, the heat of fusion of the solid substance about 16 calories. The atomic heat of liquid hydrogen, and also that of liquid nitrogen, is about 6, in accordance with the Law of Dulong and Petit. The refractive index is 1.12, the theoretical value at the boiling-point being 1.11. Hydrogen, helium, and neon have been separated from air by two methods. Xenon and krypton can be separated from air without liquefying it by drawing it, under reduced pressure, through a spiral tube filled with glass wool and immersed in liquid air kept under exhaustion. Fifteen different electrical resistance-thermometers were studied down to the boiling-point of hydrogen; they give, at that low temperature, results widely divergent among themselves and higher than that given by a gas thermometer. Helium has not been liquefied, although it has been cooled, probably to 9°–10°, by expansion from 80 atmospheres while surrounded with solid hydrogen. Organic bodies are found to increase greatly in phosphorescence, and some crystals to become highly electrified, when cooled to 20°.

On the Separation of the Least Volatile Gases of Atmospheric Air and their Spectra. By S. D. LIVEING AND JAMES DEWAR. *Am. J. Sci.*, **162**, 207–215.—Two forms of apparatus used for the fractionation of liquid air are described. After most of the oxygen and nitrogen has distilled off, the remaining gases follow in the sequence, argon, krypton, xenon. The remainder of the article is devoted to a description of the spectra of krypton and xenon and their variation with the nature of the electric discharge.

I. On an Improved Method of Determining Latent Heat of Evaporation and on the Latent Heat of Evaporation of Pyridine, Acetonitrile, and Benzonitrile. II. The Latent Heats of Evaporation of a Number of Organic Nitrogen-Bearing Compounds. By LOUIS KAHLENBERG. *J. Phys. Chem.*, **5**, 215–232; 284–288.—The author has modified the apparatus of Berthelot (*Mécanique chimique*, I, 289) by substituting for the flask-shaped boiling vessel heated by a gas flame a large test-tube heated by passing an electric current through a platinum spiral placed in the liquid within the tube. The top of the tube is closed by a cork stopper, and the vapors pass into the calorimeter beneath through a narrow glass tube fused into the bottom of the boiling

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tube and extending nearly to its top, as in Berthelot's apparatus. Determinations to test the apparatus were made with water, benzene, ethyl alcohol, and ethyl iodide, formate, and acetate; the duplicate results were found to agree always within a few tenths per cent. Four determinations of the heat of vaporization of water gave 535.7 ± 0.4 cal., in agreement with the results (536.2, 537.7, and 536.6) of other recent investigators. The heats of vaporization H (and incidentally the specific heats) of eight organic nitrogen compounds were then determined, and from these were calculated the molecular rises of boiling-point and the Trouton constants (that is, the ratios of the molecular heats of vaporization, MH, to the absolute temperatures of the boiling-points, T). The results are given in the following table:

	H.	T.	$\frac{0.02\,T^2}{H}$.	$\frac{MH}{T}$.
Pyridine	104.0	387°	28.8°	20.5
α-Picoline.....	90.75	402	35.61	21.0
Acetonitrile	173.6	353.5	14.39	20.1
Valeronitrile	95.95	402	33.69	19.8
Benzonitrile.....	87.7	462	48.67	19.5
Amylamine	98.75	368	27.42	23.3
Dipropylamine ...	75.69	381	38.35	20.0
Diisobutylamine..	65.85	407.5	50.43	20.8

The Surface-Tension of Water above 100° C. By Chas. T. Knipp. *Phys. Rev.*, 11, 129–154. The author first describes in detail the construction of a platinum-plated steel bomb capable of withstanding pressures and temperatures above the critical ones of water. The bomb is closed below by a small perforated plug connected with a pressure gauge, and above by a large plug through which insulated circuits are introduced. One of these consisted within the bomb of a coil of wire, in whose axis was an iron core attached to a thin platinum vane, while two other circuits served to indicate the level of the water and the rising of the vane. The current which had to be passed through the coil in order to raise the vane out of the liquid into the vapor was shown to be a measure of the surface-tension. The decrease in surface-tension is found to be very closely proportional to the increase of temperature between 0° and 300°. Above 300° the decrease is somewhat less rapid, except in the immediate neighborhood of the critical temperature where it is extremely rapid. The density of the saturated water vapor was also determined by measuring the current required to hold the core and vane in suspension in the vapor, but the results are regarded only as preliminary. The bomb may also be used, after replacing the plug carrying the vane and electric circuits by a simple one, for determining the vapor-pressure of water at high temperatures, and its critical temperature and pressure. The vapor-pressure values in atmospheres are 9.6 at 180°, 15.5 at 200°, 23.0 at 220°, 33.6 at 240°, 47.1 at 260°,

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65.9 at 280°, 89.0 at 300°, 120 at 320°, 160 at 340°, and 205 at 359°, the critical temperature. The critical pressure and temperature were obtained by noting the point at which the pressure-temperature curves began to diverge, when different quantities of water were present in the bomb.

Thermodynamic Notes: Revision of Some Thermal Data Concerning Benzene. By K. TSURUTA. *Phys. Rev.*, **10**, 116–122.—The article contains no new experimental material, but discusses the existing data on the vapor-pressures of benzene, its specific volumes in the state of liquid and saturated vapor, and its heat of vaporization, between 10° and 270°, and also the vapor-pressures of liquid and solid benzene below its freezing-point. The most probable values of these constants are derived.

A Determination of the Viscosity of Water. By E. R. DREW. *Phys. Rev.*, **12**, 114–120.—The apparatus used consisted essentially of two vertical coaxial cylinders, the outer capable of rotating at any desired speed, while the inner, which is closed at the ends, is suspended by means of a torsion wire between agate bearings in the axis, the liquid being contained in the space between the two cylinders. The coefficient of viscosity was found to be 0.01020–0.01023 dyne at 20°, while Poisseule previously found 0.0101.

On the Density of Ice. By H. T. BARNES. *Phys. Rev.*, **13**, 55–59.—Contrary to the results of Nichols (*this Rev.*, **5**, 50), the author was not able to detect any difference between the density of fresh river ice and that of ice which was one or two years old. The author's final value is 0.91661 ± 0.00007. Nichols' results varied for different samples from 0.9162 to 0.9181.

The Specific Heat of Solutions Which Are Not Electrolytes, II. By WILLIAM FRANCIS MAGIE. *Phys. Rev.*, **13**, 91–101.—In continuation of his previous investigation (*this Rev.*, **6**, 11), the author has determined the specific heat of aqueous solutions of various isomeric sugars and of both aqueous and alcoholic solutions of the three dioxybenzenes and of phenol. He finds that the molecular heats of many of these isomers in aqueous solution differ by 7–20 per cent. from one another, and that those of the same substance differ markedly in the two solvents, but are constant in the same solvent at different concentrations between 0.1 molar and molar.

On the Solubility of Manganous Sulphate. By F. G. COTTRELL. *J. Phys. Chem.*, **4**, 637–656.—This investigation was undertaken in order to explain the remarkable results previously obtained with this salt by Linebarger (*Am. Chem. J.*, **15**, 225). His solubility determinations are shown, however, to have been erroneous, owing to the dehydration of the salt at too low a tem-

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perature (170°) before weighing. While Linebarger obtained all seven hydrates, containing from 1 to 7 molecules of water, the author was able to obtain only those with 1, 4, 5, and 7 molecules. He has made 94 solubility determinations with these four hydrates at temperatures between — 10° and + 100°. There is nothing peculiar about the results, except that the monohydrate reaches equilibrium with its solution very slowly.

The Solubility of Manganous Sulphate. By THEODORE WILLIAM RICHARDS AND FRANK ROY FRAPRIE. *Am. Chem. J.*, **26**, 75–80; *Proc. Am. Acad.*, **36**, 509–514.—The solubility of the pentahydrated salt at 25° and that of the tetrahydrated salt at 30.15° and 35° were determined. The results confirm those of Cottrell (see preceding review) which differed greatly from the earlier ones obtained by Linebarger.

A Study of Growing Crystals by Instantaneous Photomicrography. By THEODORE WILLIAM RICHARDS AND EBENEZER HENRY ARCHIBALD. *Am. Chem. J.*, **26**, 61–74; *Proc. Am. Acad.*, **36**, 341–353.—The apparatus used consisted of a compound microscope connected above with a vertical folding camera, through a dark box containing a revolving shutter. With this apparatus, instantaneous photographs were taken, at regular intervals, of crystals separating from saturated solutions of high-melting salts, such as barium chloride, sodium nitrate, potassium iodide. The authors were unable to confirm the hypothesis that the separation of such crystals is preceded by that of liquid globules, although a globule 0.001 mm. in diameter would have been detected. They studied also the rate of growth of crystals and found that the cube of the diameter of a crystal is approximately proportional to the time elapsed since its separation from the solution; in other words, that equal increments of time correspond to equal increments of *volume*. The authors state this law with some reserve, however, owing to the approximate character of their results; but there is no doubt that the increase in diameter is extremely rapid in the early stages of growth. The article is illustrated by a diagram of the apparatus and by fourteen series of photographs of growing crystals.

The Boiling-Point Curve for Mixtures of Ethyl Alcohol and Water. By WILLIAM A. NOYES AND R. R. WARFEL. *J. Am. Chem. Soc.*, **23**, 463–468.—Determinations of the boiling-point under the atmospheric pressure were made throughout the whole range of concentration, but with especial care for mixtures containing from 92 to 100 per cent. of alcohol. A minimum boiling-point was found to exist at 78.174° (0.126° below that of pure alcohol) for a mixture containing 96 per cent. of alcohol by weight or 97.45 per cent. by volume.

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Vapor-Pressure Relations in Mixtures of Two Liquids, III. By A. Ernest Taylor. *J. Phys. Chem.*, 4, 675–689.—This paper is a discussion of the experimental results previously communicated (*this Rev.*, 6, 146) on the composition of the vapor given off by mixtures of acetone and water. It is shown that, as long as the liquid does not consist of more than 60 per cent. of acetone, the composition of the vapor agrees within 1–2 per cent. of the observed values when calculated by the formula for vapor pressure lowering

$$\left(\log \frac{p_0}{p} = \frac{n}{N}\right)$$

regarding the water as solvent; but that widely divergent results are obtained at all concentrations when the same calculation is made under the assumption that acetone is the solvent. This is probably due to the fact that liquid acetone molecules are simple, while those of water are associated. Henry's Law does not hold for either component, unless associated molecules are assumed for it; and the results are not accurate enough to make possible a satisfactory testing of this assumption.

Minimum Boiling-Points and Vapor Composition. By Morris R. Ebersole. *J. Phys. Chem.*, 5, 239–255.—The boiling-points of mixtures of benzene and acetone throughout the whole range of concentration from 0 to 100 per cent. were determined, as well as the composition of the vapor distilling from such mixtures. No constant-boiling mixture exists. In order to test Bancroft's hypothesis that two components whose vapor-pressure curves intersect at any temperature always give rise to a mixture with a maximum or minimum boiling-point, whatever may be the pressure, the author has tabulated all the pairs of substances whose vapor-pressure curves are known to intersect, and finds that only 20 out of 25 of them form a constant boiling mixture and thus conform to the hypothesis. The pairs of substances whose vapor-pressure curves do not intersect are also tabulated, and certain of these are shown to form mixtures with a maximum or minimum boiling-point.

Solvent Action of Vapors. By A. T. Lincoln. *J. Phys. Chem.*, 4, 715–731.—It is found that the distillates under atmospheric or reduced pressure from saturated aqueous, benzene, and acetone solutions of benzoic and salicylic acids do not contain more of these acids than corresponds to their partial pressures, whence it is concluded that the vapors have no appreciable solvent action upon them. The same is true of ethyl alcohol solution of camphor and naphthalene. Incidentally the vapor-pressures of benzoic and salicylic acids were determined up to 157° and 193° respectively.

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Reaction Velocity and Equilibrium. By Wilder D. Bancroft. *J. Phys. Chem.*, **4**, 705–708. In this paper is considered the relation between the expression for the velocity and that for the equilibrium of a reaction taking place in successive stages.

Dissociation Studies, II. By Wilder D. Bancroft. *J. Phys. Chem.*, **5**, 182–192.—In this paper are discussed the data already existing in regard to the transformations of acetaldehyde, paraldehyde, and metaldehyde into one another under the influence of catalytic agents.

Toxic Action of Electrolytes upon Fishes. By Louis Kahlenberg and Hugo F. Mehl. *J. Phys. Chem.*, **5**, 113–132. Rock-bass, shiners, brook-trout, and perch were placed in solutions of different electrolytes of various concentrations, and the time required to cause death was noted. Hydrochloric and nitric acids were found to be equally toxic, while sulphuric acid had to be of nearly twice the equivalent concentration to produce the same effect. Silver nitrate and sulphate were equally toxic, and were capable of producing death quickly even at a very slight concentration (0.00001 normal). Potassium cyanide and mercuric chloride were also highly toxic. On the other hand, even 0.01 normal solutions of the sulphates of copper, nickel, cadmium, and zinc had only a slow action, and magnesium sulphate, which was investigated in normal solution, was remarkably inert.

The Theory of Electrolytic Dissociation as Viewed in the Light of Facts Recently Ascertained. By Louis Kahlenberg assisted by Arthur A. Koch and Roy D. Hall. *J. Phys. Chem.*, **5**, 339–392. In this article are presented new conductivity determinations at 0° and 95°, between the concentrations of fourfold normal (or normal) and $^1/_{2000}$ (or $^1/_{8000}$) normal, of 19 common salts in aqueous solution, together with the boiling-point raising produced by all these salts, and the freezing-point lowering caused by many of them, at concentrations extending upwards from 0.1 or 0.2 normal. In the 0.1–0.2 normal solutions the agreement between the dissociation-values calculated from the conductivity and those from the freezing-point is satisfactory in many cases, though not in all. In the strong solutions (1.0–2.0 normal) there is no correspondence between them; thus for the bivalent-metal sulphates, the conductivities indicate 20–26 per cent., the freezing-points no dissociation whatever. Values still more discordant with the conductivity are derived from the boiling-point determinations; thus the halides of the alkali and alkaline-earth metals seem to be more than completely dissociated in two- to fourfold normal solutions. All the disagreements, which the author regards as strong arguments against the Dissociation Theory, are, however, based on the highly improbable assumption that the freezing-point lowering or boiling-point

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raising is still a measure of the molecular weight at concentrations where the osmotic pressure is 20–100 atmospheres. Other arguments of the author against the Dissociation Theory are its failure to give a sufficiently simple explanation of certain physiological results (see *this Rev.*, 6, 73, 147, 157), the invalidity of the Mass Action Law, the exceptions to the Nernst–Thomson rule in regard to dielectric constants and dissociating power, and the behavior of the electrical conductivity of non-aqueous solutions. The author's view seems to be that because the theory does not alone explain all the relevant phenomena of all kinds of solutions, it is unjustifiable or inadvisable to employ it at all. It is scarcely necessary for the reviewer to add that the theory has received far too many approximately quantitative verifications to be overthrown by such facts as are cited by the author.

On the Heat Evolved when Liquids are Brought in Contact with Powders. By C. E. Linebarger. *Phys. Rev.*, 13, 48–54.—Two grades of precipitated silica, having particles whose average diameters were nearly in the ratio 2 : 1, were thoroughly freed from absorbed gases and treated within a calorimeter with five different liquids. The heat effect per gram of powder is independent of the quantity of liquid, after a certain minimum quantity has been added. It was found nearly twice as great for the particles of half the diameter with all of the liquids investigated, except benzene. The heat evolved per gram of silica in the case of the sample with the finest particles was as follows: 13.80 cal. with water, 12.15 cal. with pyridine, 11.05 cal. with nitrobenzene, 8.58 cal. with toluene, and 4.09 cal. with benzene.

The Exact Relation between Osmotic Pressure and Vapor Pressure. By Arthur A. Noyes. *Phys. Rev.*, 12, 84–99.—The author shows by the consideration both of a new cyclical process and of the equilibrium conditions of an osmotic column that the exact thermodynamic relation between the osmotic pressure (P_1) and the vapor-pressure (p_1) of a solution under the pressure of its own vapor is given by the equation

$$\int_{p_1}^{p_0} v dp = (P_1 + p_0 - p_1)\ V_0\ [1 + \tfrac{1}{2}\ (P_1 + p_0 - p_1) k_0],$$

in which p_0, V_0, and k_0 are the vapor-pressure, specific volume, and compression-coefficient, respectively, of the solvent. Except for high concentrations, the term containing k_0 can be neglected, and ordinarily $p_0 - p_1$ is entirely negligible in comparison with P_1; the second member of the equation then becomes simply $P_1 V_0$, showing that the approximate osmotic pressure is calculated correctly by dividing the vapor-pressure integral by the specific volume of the solvent, and not, as has generally been done heretofore, by dividing it by the volume-change which occurs when one gram of solvent is added to a very large quantity of solution.

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The Formula for the Depression of the Freezing Temperature of Solutions. By WILLIAM FRANCIS MAGIE. *Phys. Rev.*, **12**, 240–244.—The author derives, by the consideration of a reversible cyclical process and application of the energy and entropy equations to it, a relation between osmotic pressure, freezing-point lowering, heat of fusion, and specific heats, which, aside from certain enumerated and unimportant approximations involved, he regards as an exact one. The reviewer would, however, call attention to the fact that it is inaccurate in so far as the neglect of the effects connected with the compression of the solution introduces an error, and that the osmotic pressure involved is that of the compressed solution, not that of one standing under its own pressure (see *Phys. Rev.*, **12**, 84). The author discusses the differences between his formula and the ordinary approximate one of van 't Hoff, and concludes that the direct proportionality required by the latter between osmotic pressure and freezing-point lowering is, in the case of aqueous solutions of even normal concentration, closer than the accuracy of the experimental determinations of the freezing-point requires.

The Dissociating Power of Different Solvents. A Summary. By HARRY C. JONES. *Am. Chem. J.*, **25**, 232–249.—This article contains no original experiments, but is a comprehensive review of the subject, accompanied by numerous references to the original papers.

Becquerel Rays, a Resume. By OSCAR M. STEWART. *Phys. Rev.*, **11**, 155–175.—This article is recommended to the attention of those who desire a full and connected account of the recent work on the subject of the title.

I. Gibbs' Thermodynamical Model. II. Gibbs' Thermodynamical Model for a Substance Following van der Walls' Equation. By W. P. BOYNTON. *Phys. Rev.*, **10**, 228–233; **11**, 291–303.—In the first article the author calls attention to certain difficulties which he has met with in the construction of a model which will fully represent the properties of actual bodies. In the second, the equation of the model is deduced in terms of the reduced volume, energy, and entropy which serve as the coordinates of the surface. Computations are made for the case of a triatomic gas like water or carbon dioxide, and the resulting model is discussed.

A New Conception of Thermal Pressure and a Theory of Solutions. By GILBERT NEWTON LEWIS. *Proc. Am. Acad.*, **36**, 145–168.—The author first shows thermodynamically the applicability of Poynting's equation, $dP_2 = \frac{v_1}{v_2} dP_1$, to all cases in which any two phases, whether solid, liquid, or gaseous, of a single

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component are in true equilibrium with each other ; in this equation dP_1 is the change of pressure upon one phase, dP_2 is the change of pressure on the other phase necessary to restore equilibrium, and v_1 and v_2 are the specific or molecular volumes of the two phases respectively. For example, if at 0° the pressure upon ice is increased by one atmosphere, that upon water must be increased by 1.09 atmospheres, if it is to remain in equilibrium with the ice at that temperature; for the specific volumes of the two are as 1.09 : 1. If one of the phases is a vapor that obeys the laws of a perfect gas $v_1 = RT : P_1$, and the above equation becomes $\frac{dP_1}{P_1} = \frac{dP_2}{RT : v_2}$, which expresses the remarkable result that the fractional increase of vapor-pressure is equal to the ratio of the increase of pressure upon the liquid or solid phase to the pressure which that phase would exert if its pressure were calculated from its molecular volume and temperature by the laws of Boyle and Gay-Lussac. This last hypothetical pressure the author designates thermal pressure ; for he assumes that it (instead of $\frac{1}{2}$ mu^2) is the true measure of temperature, and that it represents the pressure in the interior of a body on either side of an imaginary plane of unit area, and is equal to $n\ m\ u$ where n is the number of molecules passing in one second through that area. With the help of these assumptions, the laws of vapor-pressure lowering and of osmotic pressure are deduced. In the closing part of the paper, the relation of the theory to the equation of van der Waals' is considered.

Suggestion Regarding the Nomenclature of Heat Capacity. By Theodore William Richards. *Proc. Am. Acad.*, 36, 327–329.—The author suggests the adoption of a unit of heat capacity, to be designated the *mayer* and to be defined as the heat capacity possessed by any body which is heated 1° by one joule of heat energy. He considers that the adoption of this unit will facilitate the replacement of the calorie by the joule, and will assist students in discriminating between heat energy and heat capacity. He shows that the unit has a convenient magnitude.

The Possible Significance of Changing Atomic Volume. By Theodore William Richards. *Proc. Am. Acad.*, 37, 3–17.—The author considers that the ratio (P) of the heat $(C\,dt)$ imparted to a body to the change in volume (dv) produced by it represents the resultant inward tendency which opposes expansion by heat and other causes, and suggests that this is an approximate measure of the affinity of the particles for one another. Similarly, the increases of volume which a series of metals undergo when a definite other element (for example, oxygen or chlorine) combines with them are an indication of the relative chemical affinities involved, provided allowance be made for the

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different degrees of compressibility of the metals themselves. A number of concrete illustrations are cited. In closing, the author contends that the atomic hypothesis should be so modified as to take into account the compressible environments (the atomic shell) around the centers of gravity and of affinity.

The Two Specific Heats of Gases. By W. P. Boynton. *Phys. Rev.*, 12, 353–358.—The author deduces the corrections to be applied in calculating from the gas constant, from the velocity of sound, or from an adiabatic expansion, the specific heat ratio of an imperfect gas which conforms to van der Waals' equation.

Catalysis and Chemical Energy. By Oscar Loew. *J. Phys. Chem.*, 4, 657–659.—The author assumes that the action of many catalytic agents is due to the presence in them of labile atoms or groups which undergo violent oscillations under the influence of the heat energy of the surroundings, and thereby loosen the affinities of other compounds.

I. On the Equilibrium of Chemical Systems. II. On a Theorem of van der Waals'. III. The Fundamental Equation of a Multiple Point. IV. On a Property of the Pressure Volume Diagram. V. On Clapeyron's Equation. VI. On a Theorem of Le Chatelier. VII. On a Theorem of Roozeboom. VIII. On the Generalization of Clapeyron's Equation. IX. On the Phase Rule. By Paul Saurel. *J. Phys. Chem.*, 5, 21–65, 137–140, 170–178, 179–181, 256–258, 277–280, 281–283, 393–400, 401–403. **On the Liquefaction of a Mixture of Two Gases. Composition of the Liquid and of the Vapor.** By P. Duhem. *J. Phys. Chem.*, 5, 91–112. **A Class of Relations between Thermal and Dynamic Coefficients.** By George H. Burrows. *J. Phys. Chem.*, 5, 233–238. **Note on the Fundamental Equations of Multiple Points.** By J. E. Trevor. *J. Phys. Chem.*, 5, 259–260.—These are all purely mathematical papers dealing with various principles of physico-chemical equilibrium.

The Preparation of Osmotic Membranes by Electrolysis. By H. N. Morse and D. W. Horn. *Am. Chem. J.*, 26, 80–86.—In this preliminary notice the following method of preparing an osmotic membrane is described: A porous battery cup is first freed from air by filling it with a 0.05 per cent. potassium sulphate solution, placing it in a beaker containing the same solution, and passing an electric current into the cup until 300 cc. of liquid have entered it, as a result of endosmose. The cup is then provided with a platinum electrode and placed in another beaker containing a cylindrical copper electrode. After both electrodes are connected with a dynamo, a 0.1 normal copper sulphate solution and a 0.1 normal potassium ferrocyanide solution are poured simultaneously into the beaker and porous cup, respectively. The

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electrolysis is continued until the cup exhibits a high resistance. These membranes were tested by filling the cups with sugar solution and connecting them with open vertical tubes or with closed mercury manometers; they withstood a pressure of 4.5 atmospheres, but have not been tested beyond that point owing to mechanical difficulties in making a tight union between the cup and manometer. Moreover, they have not yet been employed for osmotic pressure measurements.

An Electrically Heated and Electrically Controlled Thermostat. By S. W. Young. *J. Am. Chem. Soc.*, **23**, 327–330.—The bath is heated by incandescent lamps beneath, through which the main current passes after having traversed a telegraphic sounder in which the circuit is made and broken by an auxiliary battery current controlled by the regulator. The regulator consists of a cylindrical glass bulb, filled with mercury, with a capillary stem above, into which the mercury expands on heating, thereby making contact with an inserted wire. The bulb has a vertical side-arm fitted with a mercury-tight cork piston, which can be raised or lowered so as to adjust the regulator to any desired temperature.

An Automatic Temperature Regulator. By Charles T. Knipp. *Phys. Rev.*, **12**, 47–49.—The motion of two pivoted copper-iron thermostats, after being multiplied by a system of levers, causes a make or break between platinum terminals in an electric circuit containing a relay, which opens or closes the main circuit which heats the bath. Temperatures from 20°–380° can be kept constant by it within 0.5°.

Note on Bunsen's Ice Calorimeter. By J. W. Mellor. *J. Phys. Chem.*, **4**, 135–136.—A description and diagram are given of a simple device for removing the dissolved air while filling the outer chamber of the ice calorimeter.

Note on Some Modified Forms of Physico-Chemical Measuring Apparatus. By Allerton S. Cushman. *J. Am. Chem. Soc.*, **23**, 482–485.—The Arrhenius resistance cell is modified by holding the glass tubes carrying the electrodes in place by means of brass set-screws tipped with ebonite which enter horizontally through the edge of the (heavy) ebonite cover. While the electrodes are thereby held very firmly in place, they can be readily adjusted at any desired distance. The author modifies the Ostwald burette-calibrator by substituting a graduated scale for the single 2 cc. mark on the upper stem; and draws off always just 2 cc., read on the burette, and notes the reading on the pipette.

On the Velocity of Chemical Reactions. By William Duane. *Am. J. Sci.*, **161**, 349–356.—Two forms of apparatus are described for measuring the rate of chemical reactions. In one of these a

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beam of light focused by a lens is passed through a prismatic tube divided diagonally into two wedge-shaped compartments; one contains the reacting mixture, and the other, in order to reduce the dispersion, is filled with the same solution which has already undergone the reaction. Owing to the change in index of refraction the beam is deflected from its original position as the reaction progresses, and its position is continuously photographed upon a plate placed at the focus and moved by clock-work. No provision is made for keeping the temperature constant. In the second form of apparatus the reacting mixture is placed in a spiral glass tube, and its change of volume is measured by the displacement of a mercury thread in a capillary tube attached to the spiral. The velocity-constants obtained for the sugar inversion with both forms of apparatus are very unsatisfactory.

An Efficient Boyle's-Law Apparatus. By W. J. Humphreys. *Phys. Rev.*, 10, 123–125. **Apparatus for Demonstrating Boyle's Law.** By F. J. Rogers. *Phys. Rev.*, 11, 112–114. **The Verification of Boyle's Law.** By N. H. Williams. *Phys. Rev.*, 11, 255–256. **An Apparatus for the Determination of the Coefficient of Expansion of Air at Constant Pressure.** By C. F. Adams. *Phys. Rev.*, 10, 178–179.—These four articles describe simple forms of apparatus which are intended for the laboratory instruction of students.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

On Dehydromucic Acid. By Henry B. Hill. *Am. Chem. J.*, 25, 439–445.—The author gives an outline of the results of the work described in two articles which follow, and are here reviewed below.

On Dehydromucic Acid and Certain of Its Derivatives. By Isaac K. Phelps and William J. Hale. *Am. Chem. J.*, 25, 445–463.—The methods of preparation of dehydromucic acid were carefully studied, and, as a result, a modification of the best method is proposed, which gives very satisfactory results. The largest yield of the acid was obtained when acid potassium saccharate was boiled for sixteen hours with hydrobromic acid of the specific gravity 1.565. In this way 40 grams of the salt gave 13.85 grams dehydromucic acid. An attempt was made to prepare the acid by the method of Schmidt and Cobenzl, who state that the potassium salt of the acid could be made by the dehydration of potassium mucate at a high temperature, in an atmosphere of hydrogen. The salt prepared in this way proved not to be the compound expected. The method and properties of the following-named substances are given fully: Dehydromucic acid, and its barium and calcium salts, the mono-

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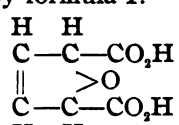
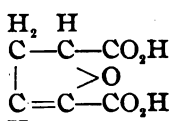
methyl (m. p. 201°–202°) and monoethyl (m. p. 148°–149°) esters, the amide (m. p. 280°–281°), dianilide (m. p. 227°–228°) and the anhydride of the acid. When the dehydrated acid was heated with acetic anhydride, it was converted into dehydromucic-diacetic anhydride, $C_{10}H_8O_7$, which decomposed rapidly at 150°. Potassium dehydromucate, in the presence of an excess of potassium carbonate, is converted by bromine into dibromfurfuran tetrabromide (m. p. 112°). Iodine also reacts with the salt and at 100° diiodofurfuran (m. p. 47°) is formed. $\alpha\alpha'$-Dibenzoylfurfuran (m. p. 107°) was readily prepared by the action of aluminum chloride on a solution of dehydromucyl chloride in benzene. No well-defined products could be obtained by the action of reducing agents on the ketone. Aqueous bromine at 140° converted it into dibrommaleic and the three brombenzoic acids. The ketone was converted into $\alpha\alpha'$-dibenzoylfurfuran diphenylhydrazone (m. p. 155°–156°). The dioxime of the ketone was separated into two isomers by making use of the hydrolytic dissociation of the sodium salts of the oxime. The α-dioxime melts at 213°–214° and the β-variety at 243°–245°.

On the Reduction of Dehydromucic Acid. By Henry B. Hill and Alvin S. Wheeler. *Am. Chem. J.*, **25**, 463–485. —The authors have studied carefully the reduction of dehydromucic acid, and have cleared up this reaction which has given different results in the hands of different observers. When the acid is reduced at 0° by means of sodium amalgam, and care is taken to prevent the accumulation of sodium hydroxide, the product is almost wholly α-dihydrofurfuran-$\alpha\alpha'$-dicarboxylic acid. When the reduction takes place at ordinary temperatures, however, the chief product is the so-called β-acid. This acid is converted by boiling with sodium hydroxide into a new compound which is called the γ-acid. As a result of a study of the reactions and properties of these acids, the conclusion is drawn that the α-acid—the first product of the reduction—has the structure represented by formula I.



I.



II.

This configuration contains two asymmetric carbon atoms and should give an inactive (cis) form and two optically active (cis-trans) forms. The α-acid is the cis form. The β-acid has the same structure but is a combination of the two active cis-trans forms. The γ-acid has the structure of formula II, and is made up of the two possible active forms. By the prolonged action of sodium amalgam the γ-acid is converted into the corresponding

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tetrahydrofurfuran dicarboxylic acid, while the α- and β-acids can not be further reduced. These facts are evidence of the correctness of the formulae proposed, for it has been shown by v. Baeyer that in the case of analogous acids, hydrogen is added, under these conditions, to doubly linked carbon atoms only when the double bond is adjacent to a carboxyl group. The three acids readily add bromine. The α- and β-dibromides are decomposed in alkaline solution in the cold with the elimination of carbon dioxide, and the almost quantitative formation of pyromucic acid. Under the same conditions the γ-acid loses carbon dioxide, but no pyromucic acid is formed. Preliminary experiments have shown that the β-acid gives two cinchonine salts of different solubilities, and that the acids prepared from these salts are optically active with opposite rotations. The γ-acid has also been resolved into optically active isomers. In addition to a full description of the compounds mentioned above, the barium, silver, lead, and calcium salts of the α- and β-acids are adequately described. Chlorine does not give with the acids addition-products as bromine does. In aqueous solution chlorine converts the α- and β-acids into the corresponding chlorhydroxytetrahydrofurfuran-αα′-dicarboxylic acids.

The Constitution of the Oxyazo Compounds. By William McPherson and Herbert C. Gore. *Am. Chem. J.*, **25**, 484–496.—In continuing the study of the structure of oxyazo compounds, the authors have investigated the action of unsymmetrical benzoyl-α-naphthylhydrazine on certain paraquinones. The results are in accord with an earlier investigation (*Am. Chem. J.*, **22**, 364), and show that the acyl derivatives of the *p*-oxyazo compounds, formed by the interaction of α-naphthyldiazonium chloride on phenol, *o*-cresol, and thymol, respectively, contain the acyl group joined to oxygen, and, hence, are true oxyazo compounds. α-Benzoyl-α-naphthylhydrazine (m. p. 98°) was prepared from β-acetylnaphthylhydrazine by first converting the latter substance into α-benzoyl-β-acetyl-α-naphthylhydrazine (m. p. 184°) by heating with benzoyl chloride and then eliminating the acetyl group by boiling with dilute sulphuric acid. With benzoquinone this hydrazine derivative yields quinonebenzoyl-α-naphthylhydrazine (m. p. 113.5°), which is converted by saponification into α-naphthaleneazophenol (m. p. 136°). This latter compound was also prepared by the action of α-naphthyldiazonium chloride on phenol, and was converted into a benzoyl derivative (m. p. 120°). By the action of benzoylnaphthylhydrazine on toluquinone and thymol analogous compounds were prepared, which were studied in the way used with the benzoquinone derivative.

Action of Phenols on Ethylic Oxalate. By J. Bishop Tingle and Leo O'Byrne. *Am. Chem. J.*, **25**, 496–501.—The authors

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find that certain phenols form condensation-products with ethyl oxalate. The compounds, which were not analyzed, will be studied further.

Certain Derivatives of Metadibromdinitrobenzene. By C. Loring Jackson and W. P. Cohoe. *Am. Chem. J.*, **26**, 1–9.—The structure of the dibromdinitrobenzene melting at 117.4° was shown to be $C_6H_2Br_2I,3(NO_2)_2 4,6$, by heating it with aniline, when it was converted into a dianilidodinitrobenzene of known structure. In the cold but one bromine atom was removed and bromanilidodinitrobenzene (m. p. 157°) was formed. This substance occurs in a yellow and a red modification which seem to differ in crystalline form. The two former can be converted one into the other. Sodium phenylate converted the dibromdinitrobenzene into diphenoxydinitrobenzene (m. p. 129°) which, in turn, was converted by sodium malonic ester into a compound in which a phenoxy group was replaced by the malonic ester group. The dibromdinitrobenzene, when reduced with zinc dust and acetic acid, gave a dibrom-*m*-phenylenediamine identical with the compound obtained by treating *m*-phenylene diacetamide with bromine. It follows that the base has the structure:

$$C_6H_2Br_2I,3(NH_2)_2 4,6.$$

On Certain Derivatives of Orthobenzoquinone. By C. Loring Jackson and Waldemar Koch. *Am. Chem. J.*, **26**, 10–46.—Previous attempts to prepare *o*-benzoquinone have been unsuccessful, because the compound is so unstable that it cannot exist in the presence of oxidizing agents. The authors have succeeded, however, in obtaining the substance in solution by preparing it by the treatment of the lead salt of pyrocatechin with iodine in chloroform solution. The preparation of quinone from hydroquinone in an analogous way showed that this new method was a good one. From the garnet-red solution the orthoquinone could not be isolated, but its presence was shown by the reactions of the dissolved substance with a number of reagents. With hydrochloric acid, pyrocatechin and its monochlor derivative were formed. Reducing agents produced pyrocatechin. Bromine formed tetrabrompyrocatechin. With benzenesulphinic acid there resulted an *o*-dioxydiphenylsulphone (m. p. 153°), isomeric with the compound prepared by Hinsberg and Himmelschein by oxidizing pyrocatechin in the presence of benzenesulphinic acid. With aniline the chloroform solution of the *o*-quinone gave a dianilidoquinoneanil, $C_6H_2(C_6H_5NH)_2O(C_6H_5N)$, which melted at 203° and proved to be identical with the substance prepared from *p*-quinone, aniline, and acetic acid. The compound has, therefore, the substituting groups in the para position. The probable cause of the reaction by which the compound is formed from an ortho compound is given, and reference

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is made to analogous transformations. The solution of the *o*-quinone, when treated with *o*-phenylenediamine, did not yield a phenazine, but the reaction seemed to consist simply in the oxidation of the diamine. On standing, the solution of the *o*-quinone deposited a black amorphous substance, which proved to be identical with the substances prepared in an earlier investigation by the action of electrolytic oxygen on pyrocatechin. From a study of this compound the conclusion is drawn that it has the structure represented by the formula $O_2(HO)C_6H_2—C_6H_3(OH)_2$, in which two of the hydroxyl groups are in the ortho position to each other. That the compound is a diphenyl derivative and not a pyrocatechin ether, was shown by the action of reducing agents, which did not convert it into pyrocatechin—a reaction which would have taken place if the two phenyl groups had been united by oxygen atoms. The presence of three hydroxyl groups was shown by making a tribenzoyl derivative, and the ketonic oxygen was indicated by the formation of substances containing nitrogen when the original compound or its benzoic ester were treated with phenylhydrazine. All the substances were amorphous and infusible. Tetrabrom-*o*-quinone was studied carefully. When treated with tetrabrompyrocatechin the following reaction took place:

$$C_6Br_4(OH)_2 + C_6Br_4O_2 = C_{12}Br_6O_4 + 2HBr.$$

The resulting compound, which was bright red in color, was shown to have the structure $C_6Br_4 : O_2 : C_6Br_2O_2$ (hexabrom-*o*-quinopyrocatechin ether) by subjecting it to reduction when, by an indirect method, the substance was converted quantitatively into pyrocatechin. This result excluded the possibility that the compound was a diphenyl derivative. In the reduction of this quinone ether, an intermediate brown product was formed which was shown to be the corresponding pyrocatechin of the formula $C_6Br_4 : O_2 : C_6Br_2(OH)_2$. A reaction similar to the above took place between tribromresorcin and tetrabrom-*o*-quinone, and a compound (m. p. 217°) of the formula $(C_6HBr_3OHO)_2C_6Br_2O_2$ was the result. When tetrabrom-*o*-quinone is evaporated to dryness with glacial acetic acid, the greater part of the quinone is converted into a white crystalline substance, melting at 230°, the analysis of which led to the formula $C_{14}H_2Br_8O_5$ or $C_{14}Br_8O_5$. The formula containing hydrogen is adopted provisionally by the authors. The properties of the new compounds prepared in the investigation are described in detail.

On the Action of Sodic Sulphite on Tribromdinitrobenzol and Tribromtrinitrobenzol. By C. Loring Jackson and Richard B. Earle. *Am. Chem. J.*, **26**, 46–55.—When an alcoholic solution of tribromdinitrobenzene ($Br_3$1,3,5$(NO_2)_2$2,4) is boiled with sodium sulphite the bromine atom between the two nitro groups is replaced by hydrogen. Tribromtrinitrobenzene

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undergoes a similar reduction and a new dibromtrinitrobenzene ($Br_2$1,3$(NO_2)_3$2,4,6) is formed, which melts at 135°. In the hope of finding an easier method of making this compound, the action of a mixture of nitric and sulphuric acids on dibromdinitrobenzene was studied. The desired compound was obtained, but mixed, however, with a large proportion of a tribromdinitrobenzene, which proved to be a new compound having the structure ($Br_3$1,2,3$(NO_2)_2$4,6). The dibromtrinitrobenzene gave styphnic diethyl ether when treated with sodium ethylate. With the same reagent the tribromdinitrobenzene gave a new bromdinitroresorcin monoethyl ether, which melted at 78°.

Symmetrical Tri-iodbenzol. By C. Loring Jackson and G. E. Behr. *Am. Chem. J.*, **26**, 55–61.—Symmetrical tri-iodbenzene (m. p. 181) was prepared from tri-iodoaniline by means of the diazo reaction. The substance proved to be identical with the compound which was prepared by Istrati by heating together benzene, iodine, and sulphuric acid. The structure of the compound was proved by converting it into a dinitro derivative, which with aniline yielded symmetrical trianilido-dinitrobenzene.

The Constitution of Gallein and Coerulein. By W. R. Orndorff and C. E. Brewer. *Am. Chem. J.*, **26**, 97–159.—The authors have reviewed with great care the work on gallein and coerulein, and have discovered facts that lead to new formulas for these substances. The composition of the acetyl derivatives of these compounds has not been firmly established heretofore, as analyses for carbon and hydrogen do not serve to settle this point. Definite conclusions, which in some cases are different from those put forward by earlier investigation, have been obtained by saponifying the esters and determining the amount of acetic acid produced. The melting-points of the carefully purified compounds do not in all cases agree with those reported by others. A number of new compounds have been prepared, which proved of value in determining the structure of the compounds under investigation. The work has established a number of important facts. The only product formed by the reduction of gallein by zinc dust in acid or alkaline solution is gallin. Gallein forms monoesters, showing that it contains one carboxyl group, and unites with three molecules of phenyl isocyanate, which proves that it contains three phenolic hydroxyl groups. Two classes of tetra-alkyl ethers, colored and colorless, are derivable from gallein, indicating that it reacts in tautomeric modifications. The compound forms a colorless tetracetate, trialkyl derivatives which resemble phenolphthalein, and a colorless trimethyl monacetate. The preparation of a pentamethyl ether, a tetracetate, and a silver salt of the tetracetate of gallin furnished evidence of the structure of gallin. Coerulein forms a triacetate, a pentacetate,

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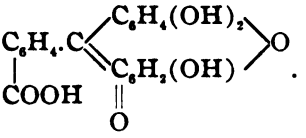
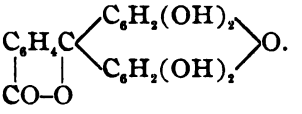
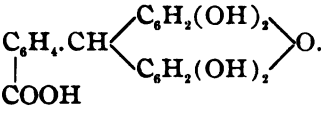
two monomethyl ethers, and a methyl ether insoluble in alkalies. From a consideration of the facts enumerated above the conclusion is drawn that the structure of gallein is represented by the formula



The fact that gallein and a number of its esters are colored is probably the result of the quinoid structure. The colorless derivatives of gallein are supposed to be derivatives of the tautomeric form



The structure which is assigned to gallin, on account of its relation to gallein, is the following:



Coerulein is the phthalidein of gallein. The compounds which are described are named below, together with their melting-points. The following derivatives of gallein: tetracetate 241°, tetrabenzoate 226°, methyl ester which did not melt when heated to 280°, ethyl ester, triphenyl carbamate, trimethyl ether 229°, tetramethyl ether which existed in two forms, colorless 195° and colored 199°, tetraethyl ether, colorless 144° and colored 155°, triethyl ether, basic lead salt, and the acetate of the trimethyl ether 197°. The tetracetate (m. p. 216°) and its silver salt and the pentamethyl ether (m. p. 127°) of gallein are described. Coerulein triacetate, two methyl ethers, and a monoethyl ether were also studied.

On the Two Modifications of Benzene-4-azoresorcin and the Constitution of the Oxyazo Compounds. By W. R. Orndorff and E. D. Thebaud. *Am. Chem. J.*, **26**, 159–166.—On account of the fact that the diacetyl derivative of benzene-4-azoresorcin yields acetanilide and amidoresorcin when reduced with zinc dust and acetic acid, the conclusion has been drawn that the compound is a hydrazone quinone, and that it has the formula

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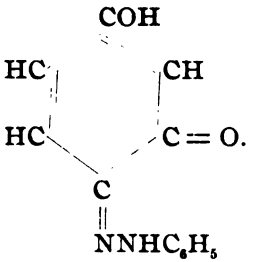

The fact that benzene-4-azoresorcin exists in two modifications can be explained if the above formula is accepted, for the double bond between the carbon and nitrogen atoms gives a chance for stereoisomerism. In order to test this view the authors have prepared a number of derivatives of benzene-α-azoresorcin, and have endeavored to separate each compound into isomers. The diacetyl derivative, prepared from either isomer, melts at 104°. When the compound was crystallized from 35 per cent. alcohol a substance was obtained which melted at 106° and had a reddish yellow color, whereas the product crystallized from ordinary alcohol melted at 104° and had a pure yellow color. The monoethyl ether of benzene-4-azoresorcin crystallizes from alcohol in short, brownish red crystals, which melt at 87°. When the product was recrystallized from dilute alcohol, it gave long, reddish yellow crystals, which melted at 88°. The diacetyl derivative of benzene-4-azoresorcin reacted with phenylhydrazine, forming a bis-phenylhydrazone (m. p. 163°). This fact is strong evidence of the correctness of the structure which has been assigned to the compound. This diacetyl compound was saponified and the corresponding bisphenylhydrazone (m. p. 160°) was isolated. In an attempt to prepare the orthomethyl ether of benzene-4-azoresorcin, a compound (m. p. 189°–190°) of the structure $C_6H_2(OH)1,(N_2HC_6H_5)_2,2,4(OCH_3)_3$ was prepared.

On the Oxygen Ethers of the Ureas: Methyl- and Ethyl-isourea. By Ralph H. McKee. *Am. Chem. J.*, **26**, 209–265. —On account of the fact that isocarbanilides,

$$C_6H_5NH.C(:NC_6H_5)OR,$$

in some of their important reactions, *e. g.* saponification and formations of amides, exhibit an entirely different behavior from that of other known ethers of analogous structure, such as acid esters RC(:O)OR and imido esters RC(:NH)OR, an exhaustive investigation of isoureas of simpler structure than the isocarbanilides was carried out. The striking difference in reaction of compounds of the same class might be produced by the difference in basicity of the compounds. This hypothesis would explain the difference in the hydrolysis of the hydrochlorides of

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the weak bases of the imidoether type, and of the stronger bases of the urea ether type. Another explanation which was suggested, *viz.*, that the differences are produced by stereochemical interference, which varies with groups of different size and weight, was subjected to investigation. The experimental results showed clearly that this view was not correct. As a step toward explaining the differences noted above, a number of ethers of the types $C_6H_5NH.C(:NH)OR$, $C_6H_5NCH_3.C(:NH)OR$, and $NH_2C(;NH)OR$ were prepared and investigated. The methods for preparing these new classes of ethers have been so developed that the compounds can be prepared as readily as any imidoether. The ethers were readily benzoylated and condensed with phenyl isocyanate. In this way isourea ethers with negative groups were obtained. Every isourea ether obtained gave an alkyl chloride and a urea on heating with dilute hydrochloric acid. The study of the behavior of the new urea ethers towards amines was not completed, but in the case of the monophenylated isoureas it was shown that in no case was the reaction with aniline a smooth one, with the formation of an amide. The simple isourea ethers show, therefore, the same characteristic lack of power to form normal saponification-products and amides as do the isocarbanilides. Reference must be made to the original paper for an account of the large number of compounds which are carefully described.

On Acetyl and Benzoylimidodithiocarbonic Esters. By Henry L. Wheeler and Treat B. Johnson. *Am. Chem. J.*, **26**, 185–206.—The possibility of stereoisomerism in acylimidodithiocarbonic esters is suggested by the presence of a double bond in the compounds between a carbon and a nitrogen atom. To determine whether such isomerism exists, methyl ethyl benzoylimidodithiocarbonate,

$$C_6H_5CO.N=C\begin{matrix}SC_2H_5\\SCH_3\end{matrix},$$

was prepared in two ways which would produce isomers if such forms exist. The compounds used had the formulas

$$C_6H_5.CO.N=C\begin{matrix}SNa\\SCH_3\end{matrix} \quad \text{and}$$

$$C_6H_5—CO.N=C\begin{matrix}S.C_2H_5\\SNa\end{matrix}.$$

The first was treated with ethyl iodide and the second with methyl iodide. The resulting product proved to be an oil in each case, which boiled at 224° at 20 mm. pressure. The question was not settled by these experiments, as even if isomers had been

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formed, the more unstable one would probably have been converted into the staple form when heated to such a high temperature. A detailed account is given of a number of experiments, which had as their aim the preparation of crystalline reaction-products. In some cases the acyldithiocarbonates were oils, in others the two methods of preparation could not be used. When the radicals introduced were the benzyl and metaxylyl groups the results were satisfactory. Crystalline products were obtained by the two methods of preparation. These compounds proved to be identical and, accordingly, it is evident that stereoisomeric acylimidodithiocarbonic esters do not result by the methods employed. When these esters are treated with amines a mercaptan is evolved, and acylpseudothioureas of a new type are formed. The behavior of the esters with hydrochloric acid and with hydrogen sulphide was also investigated. A number of new compounds prepared in the course of the work are described.

Camphoric Acid: Racemic Campholytic Acid and Racemic Dihydrohydroxycampholytic Acid. By William A. Noyes and W. M. Blanchard. *Am. Chem. J.*, **26**, 281–292.—The authors have shown that inactive campholytic acid (m. p. 31°, b. p. 127°–128° at 14 mm.) is the racemic form corresponding to α-campholytic acid. The acid required for the investigation was prepared by allowing β-campholytic acid to stand in contact with fuming hydrobromic acid for several days, and by decomposing the resulting hydrobromide with caustic soda. This hydrobromide of β-campholytic acid gradually passes over, almost completely, into the hydrobromide of the α-acid. This transformation is explained readily if the formula for campholytic put forward by the authors in an earlier paper (*Am. Chem. J.*, **24**, 286) is accepted. When the hydrobromide of the racemic α-campholytic acid is treated with caustic soda there is formed, in addition to the regeneration of campholytic acid, a small amount of the lactone first discovered by Kerschbaum and Tigges and a small, but relatively larger, amount of a new hydroxy acid, which was shown to be the racemic form of dihydrohydroxycampholytic acid (m. p. 176°), by separating it into its optically active components (m. p. 132°) and identifying the right-handed form with that acid. As this new hydroxy acid corresponds in configuration to the hydrobromide of the racemic α-campholytic acid, and as that hydrobromide is always formed by the addition of hydrobromic acid to the racemic acid, it follows that addition produces but one configuration, whereas if campholytic acid has the structure proposed by Bredt two configurations would be possible. The formula proposed by the authors is in accord with the above facts. The formation of a lactone on treating dihydroaminocampholytic acid with nitrous acid has been taken as evidence that in this acid the amino group is in the γ-position with regard to the carboxyl.

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This conclusion is now doubtful, as it has been shown that camphoric, dihydroaminocampholytic, dihydrohydroxycampholytic, and bromdihydrocampholytic acids are all active, whereas the lactone prepared from active dihydroaminocampholytic acid is inactive. This lactone has also been prepared by warming the nitroso derivative of the anhydride of dihydroaminocampholytic with sodium hydroxide. The authors show that the chief products of this reaction are active α-campholytic acid and active dihydrohydroxycampholytic acid, which, accordingly, correspond in configuration to the original amino acid. By the reduction of the hydroiodide of the racemic α-campholytic acid a new dihydro-α-campholytic acid (b. p. 245°–247°) was prepared. This acid was converted into the α-bromine derivative (m. p. 148°) which yielded a new campholytic acid which has the double union in the position Δ^5. This acid melts at 90°–91° and gives an amide which melts at 90°.

Acetanilide. By CHARLES W. GORR. *Pharm. Rev.*, **18**, 402–408.—Physical and chemical tests for acetanilide are described in some detail.

Note: Zinc-Copper Couple for Preparing Zinc Ethyl. By W. A. NOYES. *Am. Chem. J.*, **24**, 467.—Attention is called to the fact that zinc filings for the preparation of the zinc-copper couple may be replaced by a kind of granulated zinc which is on the market.

On Tritolylchlormethane. By M. GOMBERG AND O. W. VOEDISCH. *J. Am. Chem. Soc.*, **23**, 177–178.—Tritolylchlormethane was prepared by the action of carbon tetrachloride on toluene in the presence of aluminum chloride. The compound was converted into the corresponding ethoxyl derivative (m. p. 105°) when it was heated with alcohol. By the action of water on the chloride the corresponding carbinol was formed.

Note: The Nature of the Oxyazo Compounds. By WILLIAM MCPHERSON. *Am. Chem. J.*, **25**, 80.—In a recent paper the author stated that free paraoxyazo compounds do not react with phenylhydrazine. This statement the author finds to be incorrect. A reaction takes place slowly at 100° with the formation of a white crystalline substance, which is now being studied.

The Detection of Methyl Alcohol in the Presence of Ethyl Alcohol. By ALBERT B. PRESCOTT. *Pharm. Arch.*, **4**, 86–90.—The method described is briefly as follows: The diluted spirit is treated with a hot oxidized copper spiral a number of times. Hydrogen peroxide is added to destroy the acetic aldehyde, and then sodium thiosulphate to decompose the excess of the peroxide. The solution so obtained is tested for formic aldehyde by means of phloroglucinic and sodium hydroxide.

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The Revival of Organic Chemistry. By H. N. Stokes. *Science*, **12**, 537.—This paper was delivered as the annual address of the president of the Chemical Society of Washington. The author reviews briefly the history of stereochemistry, tautomerism, catalysis, and other recent theories of organic chemistry. It is clearly shown that organic chemistry offers as richly as ever before opportunities for important work. The advance in this part of the science is to come through the applications of the methods of study which have advanced empirical inorganic chemistry to the science of modern general chemistry. The study of catalytic action in the realm of physiological phenomena will without doubt lead to discoveries of great importance to the welfare of man. The paper is a strong answer to those who are of the opinion that organic chemistry no longer offers opportunity for work of scientific importance.

Camphoroxalic Acid Derivatives. By J. Bishop Tingle. *J. Am. Chem. Soc.*, **23**, 363–392.—The author gives a summary of his work on camphoroxalic acid, which has been carried out at intervals during the last twelve years, and describes new experiments on the action of ammonia and certain aliphatic amines on camphoroxalic acid and its ethyl ester.

Synthesis of Derivatives of Dimethylcyclopentanone, β,β-Dimethyladipic Acid, and α,β,β-Trimethyladipic Acid. By W. A. Noyes. *J. Am. Chem. Soc.*, **23**, 392–402.—A detailed account of the methods of preparation and properties of the substances mentioned in the title are given. The substances are of importance as they are related to 2.33-trimethylcyclopentanone, a ketone which the author has recently synthesized and shown to be identical with a ketone previously obtained from camphoric acid by a series of reactions which can be easily followed.

On Some Addition-Reactions of Thio Acids. By Henry L. Wheeler. *J. Am. Chem. Soc.*, **23**, 443–450.—The methods of preparation, properties, and reactions of the addition-products formed from thiobenzoic acid and certain amidines, amidoesters, hydrazones, ureas, and amines are described.

On Trivalent Carbon. By M. Gomberg. *J. Am. Chem. Soc.*, **23**, 496–502.—The author calls attention to some errors in his previous work, and describes addition-products of the unsaturated hydrocarbon formed by the action of zinc on triphenylchlormethane, with ether and with ethyl acetate.

Preparation of 2,5-Dimethylbenzaldehyde; The Establishment of Its Constitution and Preparation of Some of the Derivatives. By Everhart P. Harding and Lillian Cohen. *J. Am. Chem. Soc.*, **23**, 594–606.—2,5-Dimethylbenzaldehyde was prepared by Gattermann's method from *p*-xylene.

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The preparation was of interest as the aldehyde group was introduced into a position ortho to a methyl group. A number of derivatives of the new compound were prepared by the usual methods.

The Synthesis of Alkyl Ketodihydroquinazolines from Anthranilic Acid. By AUGUST HENRY GOTTHELF. *J. Am. Chem. Soc.*, **23**, 611–632.—The reaction by which ketodihydroquinazolines are prepared by the action of nitriles on anthranilic acid has been studied carefully. The conditions under which the best yield of quinazoline is obtained have been established, and a number of new substances have been prepared. The influence of acids and their anhydrides on the reaction has been determined.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

A Method for the Determination of the Available Organic Nitrogen in Commercial Fertilizers. By JOHN PHILLIPS STREET. *J. Am. Chem. Soc.*, **23**, 330–338.—The author regards the results obtained by existing methods as of doubtful value as a measure of the availability of the nitrogen present in fertilizing materials. A considerable number of experiments made by him seem to indicate that the most reliable figures are obtained by digesting the fertilizers with a 1.6 per cent. solution of potassium permanganate, on the steam-bath, and determining the total nitrogen in the residue (after washing with water) by the Kjeldahl method.

Method for Preparing Strictly Tenth-Normal, Fifth-Normal, Etc., Hydrochloric or Nitric Acid. By RICHARD K. MEADE. *J. Am. Chem. Soc.*, **23**, 343–347.—An aqueous solution of copper sulphate, in known quantity, is subjected to the action of the electric current for the removal of the copper, the resulting solution of sulphuric acid is treated with barium chloride or nitrate, the precipitated sulphate is removed by filtration, and the solution made up to the required volume.

On the Separation of Tungstic and Silicic Acids. By H. L. WELLS AND F. J. METZGER. *J. Am. Chem. Soc.*, **23**, 356–358.—The authors are unable to confirm the statement of Herting (*Ztschr. angew. Chem.*, 1901, 165) that on the ignition of silicic and tungstic acids a volatile silico-tungstic acid is formed. They were able to effect an accurate separation by treatment of the mixture with hydrofluoric acid, and only detected a loss when the temperature of the blast-lamp was employed for ignition, at which temperature tungstic acid is volatilized.

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A New Indicator for Use in Determining Total Acidity of Wines. By E. G. Runyan. *J. Am. Chem. Soc.*, 23, 402–405.—The author recommends a mixture of corallin (rosolic acid) and malachite green. The mixture shows a purple color with alkalies and a green with acids.

The Estimation of Carbonic Acid in Water. By Joseph W. Ellms and Jay C. Beneker. *J. Am. Chem. Soc.*, 23, 405–431.—The paper presents the results of comparative experiments made with the Pettenkofer, Trillich, and Lunge-Trillich methods. The authors conclude that "for ease and rapidity of manipulation, for avoidance of difficulties arising from the presence of magnesium salts, and for its greater accuracy, the Lunge-Trillich, or Seylor method, is to be preferred to either of the other two volumetric methods."

The Indirect Weighing of Quantitative Precipitates. A Rapid and Accurate Method for Determining the Weight of a Precipitate without Separating It from the Liquid in Which It Was Precipitated. By R. W. Thatcher. *J. Am. Chem. Soc.*, 23, 644–668.—The following formula is employed: $x = \frac{d(a - bd')}{d - d'}$, in which x = the weight of the precipitate, d and d' the densities of precipitate and liquid respectively, and a the total weight and b the total volume of the liquid and precipitate together. The author has applied the procedure to the determination of chlorine as silver chloride, of sulphur as barium sulphate, of calcium as calcium oxalate, of phosphoric acid as phosphomolybdate, and of reduced cuprous oxide. He considers the procedures more rapid and accurate than the usual gravimetric methods. The original article contains many interesting details.

The Electrolytic Determination of Molybdenum. By Lily Gavit Kollock and Edgar F. Smith *J. Am. Chem. Soc.*, 23, 669–671.—Molybdenum is precipitated electrolytically from solutions acidified with sulphuric or acetic acids, as a black, adherent coating of hydrated sesquioxide. This cannot safely be weighed, but may be dissolved in nitric acid and ignited and weighed as molybdic acid. Analyses of molybdenite may be hastened by the application of this procedure to the aqueous solution of the fusion with sodium carbonate and nitrate. In this case acetic acid must be used if the sulphur is to be determined.

The Determination of Sulphur in Iron and Steel. By William A. Noyes and L. Leslie Helmer. *J. Am. Chem. Soc.*, 23, 675–679.—The authors find that the best results are obtained by solution of the iron or steel in bromine and water, or in dilute nitric acid and potassium bromide, with the addition of potassium

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chlorate. The sulphur in the residue (if any) is determined by fusion with sodium carbonate and potassium nitrate. The sulphur in the original solution is precipitated after the removal of the iron by ammonia.

F. J. MOORE, REVIEWER.

Estimation of Calcium, Strontium, and Barium, as the Oxalates. BY C. A. PETERS. *Am. J. Sci.*, **162**, 216–224.—The authors sum up the results of their work as follows: "In the estimation of calcium by titration of the oxalate with permanganate, accurate results may be obtained when hydrochloric acid (with a manganous salt) is used as the solvent. Strontium salts may be precipitated by ammonium oxalate with practical completeness in a solution containing one-fifth its volume of 85 per cent. alcohol, and with approximate completeness from water solutions at a dilution not exceeding 250 cc. Furthermore, strontium oxalate may be titrated by permanganate with accuracy when either sulphuric or hydrochloric acid (with a manganous salt) is used to liberate the oxalic acid. Barium salts may be precipitated with practical completeness by ammonium oxalate in a solution containing one-third its volume of alcohol (85 per cent.) and the barium oxalate thus obtained may be dissolved in hydrochloric acid and titrated by permanganate after the addition of a manganous salt. Strontium and barium oxalates may be converted to the carbonates by ignition and weighed as such."

The Analysis of Slags and Cinders. BY CAVELIER H. JOÜET. **Part II. Iron and Manganese Slags.** *School Mines Quart.*, **22**, 140–152.—This paper is one of a series upon the same subject. (See *this Rev.*, 7, 40.) It is not adapted for condensation.

Blast-Furnace and Steel Works Chemistry. BY J. M. CAMP. *Iron Trade Rev.*, **34**, (No. 12) 11.

The Quantitative Determination of Cadmium. BY EDMUND H. MILLER AND ROBERT W. PAGE. *School Mines Quart.*, **22**, 391–398.—The authors sum up the results of their work as follows: "(1) The electrolytic determination of cadmium is most accurate and satisfactory, provided a large excess of potassium cyanide and the presence of other salts are avoided. (2) The carbonate method is the most troublesome and the least accurate. (3) The cadmium ammonium phosphate contains one molecule of water of crystallization and can be dried without decomposition at 100°–103°. (4) Austin's method for cadmium is unsatisfactory. (5) Asbestos filters should be avoided on account of the solubility of the fibers in either ammonium phosphate or nitric acid. (6) Cadmium can be determined with great accuracy by precipitating in the cold, in a neutral solution,

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by a large excess of acid ammonium phosphate, and allowing to stand over night; it can be weighed on balanced filters or ignited to pyrophosphate. If precipitated in a boiling solution, or on prolonged boiling, it is liable to change in composition and give low results. We recommend this method as preferable to the carbonate method in all respects, and while no more accurate than the electrolytic method, it has the practical advantage of requiring no extraordinary or expensive apparatus."

The Volumetric Determination of Zinc. By PERCY H. WALKER. *J. Am. Chem. Soc.*, **23**, 468–470.—Stolba's method for the determination of magnesium may be successfully applied to the determination of zinc. The zinc is first precipitated as zinc ammonium phosphate. This is filtered off, and titrated with standard acid. The presence of considerable quantities of iron, calcium, and magnesium salts does not interfere with the accuracy of the results, but manganese must be previously separated.

The Oxidation of Nitrogen as a Source of Error in the Estimation of Hydrogen and Methane. By ALFRED H. WHITE. *J. Am. Chem. Soc.*, **23**, 476–482.—The author sums up the results of his investigation as follows: "Oxides of nitrogen are always formed in explosion analysis in amount increasing with the violence of the explosion. The dilution recommended by Bunsen, when exploding in eudiometer tubes under reduced pressure, is not sufficient when working with the Hempel explosion-pipette. If the explosive ratio is kept between four and three, the error is negligible in the technical analysis of gases almost entirely hydrogen. The presence of small amounts of methane increases the error, and if large amounts of methane are present, the error may easily amount to a per cent. or more. The explosive ratio should be kept between four or three as in the case of hydrogen. The method of Dennis and Hopkins tends to give high results, and the errors may easily become of importance if care is not taken to avoid heating the spirals too hot and too long. Neither the explosion method nor any method involving active combustion can give strictly accurate results."

A Rapid Method for the Determination of Arsenious Oxide in Paris Green. By S. AVERY AND H. T. BEANS. *J. Am. Chem. Soc.*, **23**, 485–486.—The sample is suspended in water, and dissolved by the addition of a little concentrated hydrochloric acid. The arsenic present is then determined volumetrically by oxidation with iodine in a solution of sodium bicarbonate. The copper is held in solution by means of a solution of sodium potassium tartrate. The authors find that the presence of copper does not interfere with the determination of the end-point. Results are a little higher than by other methods.

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Modified Williams' Method for Manganese. By RANDOLPH BOLLING. *J. Am. Chem. Soc.*, **23**, 493–496.—The modifications introduced by the author are directed toward rendering the filtration of the precipitated manganese dioxide more rapid.

The Electrolytic Separation of Mercury from Copper. By ROSCOE SPARE AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 579–582. The authors defend their electrolytic method against the criticisms of Goecke and others. The results of several analyses are added.

Precipitation and Separation of Silver in the Electrolytic Way. By W. H. FULWEILER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 582–585. Silver may be determined electrolytically in cyanide solutions containing three or four other metals, for example, copper, cadmium, and zinc. Records of analyses illustrating the necessary conditions of concentration, strength of current, and so forth, are presented in tabular form.

Notes on the Analysis of Explosives. By F. W. SMITH. *J. Am. Chem. Soc.*, **23**, 585–589.—Methods are described in detail for the determination of sulphur and nitroglycerine in dynamite, also some suggestions upon the standardization of Lunge's nitrometer.

The Electrolytic Method Applied to Uranium. By LILY GAVIT KOLLOCK AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 607–609.—This article consists almost entirely of tables containing the results of analyses showing how uranium can be successfully separated by electrolysis from iron, barium, calcium, magnesium, and zinc.

Sampling Pig Iron. By W. G. SCOTT. *Foundry*, **17**, 242–245.—Ten pigs are selected from each lot with reference to the relative properties of close, medium or open-grained. An equal amount of borings is taken from each pig and the whole intimately mixed. In taking the borings the ends of the pigs selected are broken off and holes drilled in the face of each in a circle about half-way between the centre and circumference of the pig. The latter part of the article is devoted to a discussion of the way in which various qualities of the pig iron should be mixed in order to secure castings suitable for different purposes.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

A Modification of the Sulphuric Acid Test for Formaldehyde in Milk. By A. GUSTAV LUEBERT. *J. Am. Chem. Soc.*, **23**, 682–683.—Five grams of coarsely powdered potassium sulphate are placed in a 100 cc. flask, 5 cc. of the milk distributed over it

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by means of a pipette and 10 cc. of sulphuric acid (sp. gr. 1.84), carefully poured down the side of the flask. If formaldehyde is present the violet coloration of the potassium sulphate will take place in a few minutes. The test is said to be sensitive to a dilution of at least one part of formaldehyde in 250,000 parts of milk.

Household Tests for the Detection of Oleomargarine and Renovated Butter. By G. E. Patrick. *U. S. Dept. Agr., Farmers' Bull.*, 131, 1–11.—Two tests, the boiling or "spoon" test and a modification of the Waterhouse test (*this Rev.*, 7, 119), are described which should enable any one, with the ordinary kitchen facilities, to distinguish in most cases between genuine butter, renovated butter, and oleomargarine.

Analyses of Miscellaneous Food Materials. By Chas. D. Woods and L. H. Merrill. *Me. Agr. Expt. Sta. Bull.*, 75, 89–112.

On the Qualitative Determination of the Organic Acids in the Fruit of Rhus Glabra, L. and of Rhus Canadensis, Marsh. By Edo Claassen. *Pharm. Rev.*, 19, 345–347.—Experimental evidence is presented to show that it is practically impossible to extract from a liquid, containing a great deal of organic substances, the malic acid in the form of its neutral ammonium salt. A method is proposed which is fairly rapid and gives good results in the determination of the acids in fruits, leaves, etc.

The Extraction of Morphine with Immiscible Solvents. By W. A. Puckner. *J. Am. Chem. Soc.*, 23, 470–473.—Experiments were carried out to ascertain whether, in extracting morphine from solution by a mixture of chloroform and alcohol, the alkaloid might not be liberated by ammonium hydroxide instead of fixed alkali. The results show that ammonium hydroxide does combine with morphine to form a salt not readily taken up by alcohol-chloroform but that it does so to a much less extent than sodium hydroxide. A great excess of alkali should be avoided.

Opium Assay. By A. B. Stevens. *Pharm. Archives*, 4, 81–86.—The author uses a modification of the lime method, making a correction for the amount of morphine lost during the assay. Detailed directions for the procedure are given.

Recent Progress in the Study of Vegetable Foods and Drugs. By Henry Kraemer. *Pharm. Rev.*, 19, 387–398.—This paper is a comprehensive résumé of the important work done during the past year on the properties and constituents of vegetable foods and drugs.

A New Alcohol Table. By A. B. Lyons. *Pharm. Archives*, 4, 101–106.

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H. P. TALBOT, REVIEWER.

A Comparison of the Solubility of Acetylene and Ethylene. BY SAMUEL AUCHMUTY TUCKER AND HERBERT R. MOODY. *J. Am. Chem. Soc.*, **23**, 671–674.—The separation of these gases by means of ammoniacal cuprous chloride, alcohol or acetone was unsuccessful owing to the solubility of the ethylene in these reagents, while Nordhausen acid holds back acetylene as well as ethylene. An ammoniacal silver solution, however, absorbs acetylene and holds back but a trifling amount (about 0.2 cc. in 26 cc.) of the ethylene, admitting of a separation sufficiently exact for many purposes.

F. H. THORP, REVIEWER.

A New Method of Adulterating Wine. Note. *J. Franklin Inst.*, **152**, 178.—Red wines may be decolorized and made to resemble the more expensive white wines by treatment with bone-black and potassium permanganate. The chief interest in the item lies in the method proposed for the detection of this sophistication; 10 cc. of the wine are treated with 0.5 cc. of caustic soda solution, and then 1 cc. of hydrogen dioxide added, and the mixture is shaken. If the wine is doctored, the test assumes a mahogany-red color.

E. H. RICHARDS, REVIEWER.

Standard Method of Water Analysis. BY GEORGE W. FULLER. *Eng. Record*, **44**, 296–299.—This paper is a report made to the chemical and bacteriological section of the American Public Health Association by a committee. The work undertaken is indicated by the title and is an excellent example of what may be accomplished by cooperation.

The Estimation of Carbonic Acid in Water. BY JOSEPH W. ELLMS AND J. C. BENEKER. *J. Am. Chem. Soc.*, **23**, 405–431.—The paper gives detailed statements of experiments upon three methods of determining carbonic acid, resulting in a recommendation of that known as the Lunge-Trillich or Seyler method, in which the free carbonic acid is titrated with sodium carbonate with the help of phenolphthalein.

INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Chemistry of Deposits in Steam Boilers. BY W. E. RIDENOUR. *J. Franklin Inst.*, **152**, 113–118.—An analysis of Schuylkill river water is given, together with a calculation in which it appears that a thousand horse-power plant, evaporating 4 gals. per horse-power per hour, deposits 671 lbs. of sediment per month of twenty-six working days. The author divides boiler deposits into four classes: (1) the calcium sulphate scales;

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(2) the calcium carbonate scales; (3) the silicate scales; and (4) the magnesia scales. The properties of these four scales are discussed briefly and analyses of typical scales in each class are given. The silicate scales contain calcium silicate, supposed to be formed during violent boiling under pressure, by reaction between free silicic acid and the calcium carbonate in the water. Analyses of a Pennsylvania water containing silica, and of the scale which formed from it are given, and it appears that the calcium carbonate present in the water, completely disappeared before the formation of the scale. No characteristic physical appearance could be attributed to the silicate scales. It is also shown that an opinion of the water supply should not be based on the analysis of a single sample of the scale, for this differed in the various parts of the boiler; a sample from near the feed-pipe contained mainly calcium carbonate, precipitated by the volatilization of the free carbonic acid, when the water first encounters the heat, while the scale from the bottom plates, the hottest part of the boiler, showed a large percentage of calcium sulphate.

The Portland Cement Industry in New York. By Edwin C. Eckel. *Eng. News*, **45**, 365–367. A summary of the early history of the industry is given, followed by descriptions of the material used at each of the several plants in the state and analyses of their products. The technology of Portland cement-making, as carried on in these plants, is discussed and it appears that there is considerable diversity in the methods employed. The rotary furnace, the ball mill, and the tube mill are meeting with constantly increasing favor.

The Purification of Acetylene Gas. By George W. Kuchler. *Eng. Rev.*, **9**, 21–22.—This is a popular article recommending the use of "puratylene" for the removal of hydrogen sulphide and phosphide from crude acetylene gas, generated from calcium carbide. It is claimed that the presence of phosphoretted hydrogen, especially, gives the gas a foul odor, leads to obstruction of the burners through deposition of carbon, and renders the gas self-inflammable. Puratylene is a special preparation of chloride of lime, which consists of porous lumps, thus admitting of intimate and thorough contact of the gas with the purifying agent. It also dries the gas.

Charcoal Production and Recovery of By-Products in Germany. By Frank H. Mason. *U. S. Consular Rep.*, **66**, 253–261.—This report gives a very good résumé of the method of distilling wood and of the properties and mode of separation of the several products.

Improvement in Welsbach Gaslights. By Frank H. Mason. *U. S. Consular Rep.*, **66**, 262–265.—In this report is described

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the invention of R. Langhans for treating the thoria-ceria mantle with the silico-zirconate of soda, whereby the mantle is rendered stronger, the candle-power made more permanent, and the tendency to shrinkage is much reduced. The life of the improved mantles is set at from eighteen hundred to two thousand hours.

Electrolysis in Bleaching Textiles. By ERNEST L. HARRIS. *U. S. Consular Rep.*, **66**, 265–270.—The report consists of a description of the apparatus of Oettel, Haas, and Stahl for producing "chemic" or sodium hypochlorite liquor for bleaching. Illustrations of the apparatus are included.

Utilization of the Waste from the Use of White Metals. By JOSEPH RICHARDS. *J. Franklin Inst.*, **151**, 445–455; **152**, 59–63.—The paper deals with the recovery or utilization of silver, tin, zinc, antimony, bismuth, lead, and mercury, from the various wastes produced in the arts. Scrap tin as tin plate averages about 3 per cent. tin, while the cleaned iron has value for puddlers' use. The tin clippings, held in a wooden cage, were immersed in a cask containing hydrochloric acid for ten minutes, or until the tin was dissolved. The cleaned scrap was washed in water, immersed in a tank of lime water, washed again, and dipped into copper sulphate solution for a short time. The film of copper sulphate deposited on the iron in this way, prevented rusting. The iron was then worked into blooms for sheet metal. The acid finally became neutralized and yielded a solution of tin chloride. Into this solution the wooden cage, now filled with scraps of galvanized iron, was put, whereby metallic tin was precipitated by the zinc, and a solution of zinc chloride obtained. The precipitated tin was melted into ingots, and sold, about 600 pounds being obtained from 10 tons of scrap. The zinc chloride liquor was sold for disinfectant purposes and for fire-proofing wood. It is now proposed to deposit the tin electrolytically. Galvanizing wastes consist of sal-ammoniac skimmings composed of zinc oxide and the double chloride of zinc and ammonium; of zinc skimmings, containing zinc oxide and metallic zinc pellets; and of zinc dross, composed of an alloy of zinc and iron. The sal-ammoniac skimmings were leached with hot water and steam, recovering a solution of the zinc and ammonium chlorides, which was evaporated and recrystallized for use in the bath a second time; the residue, consisting of zinc oxide and metallic shot, was put into a tumbling barrel having fine openings through which the oxide escaped as powder, leaving the clean shot for remelting. The oxide was sent to the makers of zinc white. The treatment of the zinc-iron dross required much experimenting. By blowing in superheated steam and adding sulphur, the iron was separated. Cyanides had the same effect; so the dross was treated with ma-

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terials which form steam and cyanides. A mixture of sulphur, potatoes (for their water content) and leather scrap was injected into the molten metal and boiled fifteen minutes; finally a definite, small amount of aluminum was added to deoxidize and render the metal perfectly fluid before it was bailed into molds. The addition of 5–10 per cent. aluminum also improves the galvanizing bath. Electricity was used in refining the zinc and yielded very pure metal, but was not a success financially. Mercury was removed from old zinc by refining as above in a covered pot having a condenser attached. The mercury distilled off readily. Zinky-lead was melted and allowed to stand, the zinc rose and the lead settled to the bottom. Keeping the heat just high enough to melt the lead, the floating, pasty zinc was skimmed off, and the lead cast into ingots. The lead contained about 3 per cent. zinc, but was useful in many ways. Britannia metal and pewter which had been silver-plated were stripped by dipping into nitric acid, and the silver was recovered by precipitation with salt and reduction with carbon. The residue of tin, lead, and antimony is used for type and Babbitt metals, the requisite amount of tin, lead, or antimony being added to correct the composition. Oxide skimmings from solder-making were washed to recover clean shot metal and then reduced with carbon. The crude metal was treated with zinc sulphate to remove arsenic, with sulphur to remove antimony, and with superheated steam to separate the iron. A continuous furnace was devised to do this, the copper and iron being partly slagged out and the other impurities volatilized. The crude metal is liquated on an inclined hearth, separating from the residue of copper, iron, and antimony. The copper and antimony residues are used for Babbitt metal, or, if containing an excess of copper, they are used in brass.

Soil Solutions. By F. K. Cameron. *U. S. Dept. Agr., Div. Soils, Bull.* 17.—In this bulletin are considered the nature and functions of soil solutions and the classification of alkali soils. The occurrence of small spots of alkali in the humid regions is also noted.

Solution Studies of Salts Occurring in Alkali Soils. By Frank K. Cameron, Lyman J. Briggs, and Atherton Seidell. *U. S. Dep't. Agr., Div. of Soils, Bull.* 18.—The following problems form the basis of these investigations: (1) the equilibrium between carbonates and bicarbonates in aqueous solution; (2) solubility of gypsum in aqueous solutions of sodium chloride; (3) solubility of gypsum in aqueous solutions of certain other electrolytes; (4) solubility of calcium carbonate in aqueous solutions of certain electrolytes in equilibrium with atmospheric air; (5) chemical examination of alkali soils; and (6) estimation of carbonates and bicarbonates in aqueous solution.

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Process of Purifying Bauxite. By CHARLES M. HALL. *U. S. Pat. Nos. 677207, 677208, 678732.*—The object of the invention is to obtain a pure alumina suitable for reduction in the electric furnace, from impure bauxite containing silicon, as silicate of aluminium or other form, titanium, or iron. The process consists in fusing the bauxite with very little or no flux, in an electric furnace and subjecting it to a reducing action for sufficient time to reduce the impurities, leaving the greater part of the alumina unreduced. The impurities are caused to combine with a heavy metal such as iron, to form an alloy which segregates from the fused alumina, and may be removed. Bauxites containing iron in considerable amount furnish sufficient metal to alloy directly with the impurities. But if the iron content is small, it is best to add more metal or oxide to alloy with the reduced silicon and titanium. The bauxite is mixed with 5 to 10 per cent. of carbon (powdered coke, charcoal) and calcined to remove water. During calcination some iron is reduced to metal or lower oxides, thus lessening the work to be done in the electric furnace. The calcined bauxite is then mixed with more powdered carbon to bring the total amount to 8 or 10 per cent. and transferred to an electric furnace, which is lined with carbon. Very impure bauxite requires a higher percentage of carbon, but a large excess must be avoided as it wastes alumina and causes difficulty in the process. When the silicon and titanium are reduced and alloyed; the alumina is removed from the furnace.

Fertilizers. *Lab. Inland Revenue Dept., Canada, Bull.*, **75**; *Me. Agr. Exp. Sta. Bull.*, **74**; *N. C. Sta. Bull.*, **176**, 15–22; *Bull.*, **177**, 37–97; *Wash. Sta. Bull.*, **86**; *Ky. Sta. Bull.*, **90**; *Penn. Dept. Agr. Bull.*, **72**; *Vt. Sta. Bull.*, **86**; *Mass. Hatch Sta. Bull.*, **74**; *Md. Agr. College Bull.*, **11**; *N. C. Bd. Agr. Bull.*, **22**; *La. Sta. Bull.*, **63**, 483–576, 592–595; *Wis. Sta. Rep.*, **1900**, 73–75; *Ky. Sta. Bull.*, **88**, 125–173; *S. C. Sta. Bull.*, **64**.

Report of Analyses of Paris Green and Other Insecticides in 1900. By L. L. VANSLYKE AND W. H. ANDREWS. *N. Y. Sta. (Geneva) Bull.*, **190**, 283.—Twenty-two samples of Paris green and a number of proprietary insecticides were examined. Some variation was found in the arsenic content of the greens, but the commercial article was considered quite satisfactory. Microscopic examinations of the greens as a test of their purity gave no satisfactory results.

Marls. By H. A. HUSTON, W. J. JONES AND A. H. BRYAN. *Ind. Sta. Rep.* **1900**, 76–77.—This is a study of the marls found in the State, with analyses of several of them and a discussion of their use in fertilizer- and cement-making.

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Utilization of Sugar-Beet Waste. By MAX J. BEAHR. *U. S. Consular Rep.*, **66**, 357–360.—The question of utilizing the leaves and beet heads which are cut off when the beets are gathered, has been solved to a certain extent in the past, by leaving the material on the ground for fertilizing. It has not been available for cattle food because of the dirt with which it is mixed, and when put into a silo, the fermentation causes very great loss of structural constituents. Moreover, the fresh leaves contain oxalates of sodium and potassium, which act as poisons when fed to animals. But it is said that mixing lime with the leaves in the silo or adding it to the food, makes it available as food for stock. A process for drying this waste has been recently patented which makes possible its utilization as fodder. The material is dried by hot air in a revolving drum and the oxalates are said to be decomposed by this process, and yet the sugar content preserved. The leaves are then sliced into thin sections and the drying completed. The sand and earth are shaken out of the mass during the process of drying.

Artificial Stone. By JOHN L. BITTINGER. *U. S. Consular Rep.*, **66**, 361–362.—This is an account of the invention of W. Owen, whereby quartzose sand and powdered hydraulic lime are mixed dry, packed tightly in strong steel molds and placed in boiling water under pressure of 60–70 lbs. per square inch. The water slakes the lime, which by its expansion, exerts great pressure on the mold. When the lime is completely slaked, the mold is opened and the contents present much the appearance of solid stone.

Mond Fuel Gas in Great Britain. By JAMES BOYLE. *U. S. Consular Rep.*, **66**, 515–517.—This report contains a fairly complete description of the Mond gas producer, with some details as to the use of the gas.

The Manufacture of Bronze Powders in Germany. By FRANK H. MASON. *U. S. Consular Rep.*, **67**, 65–68.—These powders are produced from leaves of "Dutch metal," an alloy of copper and spelter (impure zinc). The copper and spelter are melted together in graphite crucibles holding 400 lbs. of the alloy; this is cast into ingots 2 feet long by half an inch thick. These rods are rolled cold, into ribbons which are annealed over a wood fire to avoid discoloration by sulphur. After softening they are cleaned in an acid bath, cut up and put under hammers, and beaten into thin foil. The foil is again annealed and then beaten into leaf metal by hand. The powders are made by grinding the leaf metal into impalpable powder. Some olive oil having been added, the grinding is continued for one to four hours; then the excess of oil is removed by heating under pressure, and the powder graded by putting it into a centrifugal machine and whirling,

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the powder depositing on enclosed shelves according to its gravity, the finest dust on top, and the coarser material at the bottom.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

On the Toxic Value of Mercuric Chloride and its Double Salts. BY JUDSON F. CLARK. *J. Phys. Chem.*, **5**, 289–316.—The author finds that the toxic effect of very dilute mercuric chloride solutions upon molds, yeasts, bacteria, or phanerogams, is greatly increased by the first additions of alkali-metal chlorides or hydrochloric acid, but is decreased by much larger additions. As the mercuric chloride becomes more concentrated, the increase due to the added substance becomes less, and finally disappears; and mixtures of mercuric and sodium chlorides were prepared which actually became more toxic when largely diluted. The author attributes the increase in toxicity caused by the first additions of substance, to the complex ions ($HgCl_4''$) and the subsequent decrease to the conversion of these into the undissociated complex salt (Na_2HgCl_4).

On Bilirubin, the Red Coloring-Matter of the Bile. BY W. R. ORNDORFF AND J. E. TEEPLE. *Am. Chem. J.*, **26**, 86–92.—Bilirubin, prepared from ox gall-stones, was purified and finally crystallized from pure dimethyl aniline. The product was completely soluble in chloroform and left no residue on ignition. The nitrogen in it, determined by the Kjeldahl and by the absolute method, was 9.21 per cent., the theory for $(C_{16}H_{18}N_2O_3)_x$, requiring 9.81. The results of analysis agreed fairly well with the formula $C_{34}H_{36}N_4O_7$. Attempts to determine the molecular weight of bilirubin were unsuccessful. Experiments made to learn its exact constitution indicated that it contains neither an alkoxy group nor crystal alcohol. Studies in this direction are still in progress.

Studies on the Vegetable Proteids. BY THOMAS B. OSBORNE. *Ann. Rep. Conn. Agr. Expt. Sta.*, **1900**, 388–471.—In continuation of his valuable work on the vegetable proteids the author has made a special study of the globulin edestin, which offers exceptional advantages for investigation. The reactions of edestin with definite quantities of acids and alkalies have been closely studied and the basic character of the proteids more firmly established. The amount of total and of loosely bound sulphur in a number of proteids has been determined. For a detailed account of the methods employed and the results attained reference should be made to the original paper.

The Chemical Nature of Enzymes. BY P. A. LEVENE.

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J. Am. Chem. Soc., **23**, 505–508.—The claim has recently been put forward by Friedenthal that the enzymes possess the nature of nucleo-proteids. This is contradicted by the author, whose experiments on the self-digestion of trypsin showed that after six weeks nucleo compounds were entirely decomposed but the solution still possessed tryptic activity. Only those solutions were active which gave a biuret test, which would seem to indicate the proteid nature of trypsin.

Note on the Analysis of Nucleic Acids Obtained from Different Sources. By P. A. Levene. *J. Am. Chem. Soc.*, **23**, 486–487.—The analysis of vitellinic and ichtulinic acids showed that these two paranucleic acids of divergent origin have practically the same composition. The nucleic acids analyzed were those of the cod-fish pancreas and sperm, and of the Bacillus tuberculosis. The glycogen which precipitates with nucleic acid from tissues can be removed by means of copper chloride with which the nucleic acid forms a salt insoluble in water, while the glycogen copper compound is soluble.

On the Excretion of Kynurenic Acid, II. By Lafayette B. Mendel and Edward C. Schneider. *Am. J. Physiol.*, **5**, 427–456.—Kynurenic acid is regularly found in the urine of fasting dogs. It is always present when the putrefactive processes in the intestine have been completely checked by calomel, and the excretion of it is augmented by iodoform. With salol and naphthalene the output is checked. Poisons like phosphorus and phlorhizin, which stimulate proteid katabolism, greatly increase the output of kynurenic acid. The acid is not obtained after feeding elastin, hydrated cartilage, ovomucoid, or thymus alone, these substances producing effects comparable to that of gelatin, but is obtained after the ingestion of pancreatic and lymphatic glands, blood-fibrin and the pure vegetable proteid amandin. When proteids are broken down beyond the point where products giving the biuret reaction are present, the organism no longer responds in the usual way and kynurenic acid is not formed. Attempts to obtain evidence of the synthesis of kynurenic acid from tyrosin under various conditions failed.

A Preliminary Report on the Active Principle of the Suprarenal Gland. By T. B. Aldrich. *Am. J. Physiol.*, **5**, 457–461.—The author has separated in a pure form the active principle of the suprarenal gland, described by Takamine (*Therapeutic Gazette*, 1901, 221), under the name "Adrenalin." An analysis of the substance gave the following figures: C = 57.89; H = 7.23; N = 7.50; O = 27.27. The simplest body calculated from these data has the empirical formula, $C_9H_{13}NO_3$. The suggestion is made that the active principle of this gland is connected with the "epinephrin" of Abel.

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The Formation of Allantoin from Uric Acid in the Animal Body. By ROBERT E. SWAIN. *Am. J. Physiol.*, **6**, 38–47.—The author has shown experimentally, as has been demonstrated previously by others, that allantoïn is excreted by the dog after ingestion of uric acid. Considerable amounts of the latter substance, however, may go beyond the allantoïn stage. After uric acid feeding the output of uric acid in the urine is only slightly increased.

Some Decomposition Products of the Crystallized Vegetable Proteid Edestin. By P. A. LEVENE AND LAFAYETTE B. MENDEL. *Am. J. Physiol.*, **6**, 48–52.—It is shown that edestin resembles the ordinary animal proteids in yielding the three known hexon bases, arginin, lysin, and histidin, and differs from the alcohol-soluble proteids of vegetable origin which fail to yield lysin among their decomposition products.

Some Points in the Early History and Present Condition of the Teaching of Chemistry in the Medical Schools of the United States. By J. H. LONG. *Science*, **14**, 360–372.—This most interesting historical sketch and discussion of present conditions constituted the vice-presidential address before the Section of Chemistry at the Denver meeting of the American Association for the Advancement of Science. It is, unfortunately, impossible to review it adequately.

The Origin of Oxalic Acid from Protein and Protein Derivatives. By ARTHUR E. AUSTIN. *Boston Med. Surg. J.*, **145**, 181–186.—Laboratory tests and feeding experiments are described which indicate that oxalic acid is derived from the carbohydrate group in albumins, first passing, however, through the stage of glycocoll, the remainder of the protein being converted to urea. This process is essentially a vital one though imitated by strong oxidizing agents. Oxalic acid may also be derived from uric acid by fermentative action and oxidizing agents, possibly also by vital processes. It is probable that oxalic acid is a metabolic product, being present in many organs of the body, practically absent in the solid excretion of animals fed on foods which do not contain it, yet found always in the urine after long periods of fasting.

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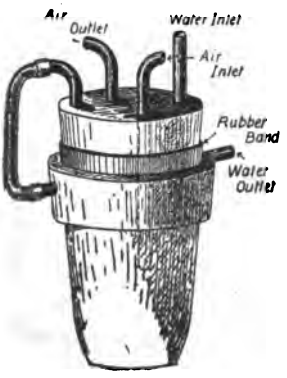

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REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 12.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Note on the Variation of the Specific Heat of Water between 0° and 100° C. By H. L. CALLENDAR AND H. T. BARNES. *Phys. Rev.*, **10**, 202–214.—The method used consisted in measuring, by means of a pair of differential platinum thermometers, the rise of temperature in a continuous stream of water, which was heated by a constant electric current of measured intensity and potential, passed through a platinum wire in the axis of the flowing water. Assuming Lord Rayleigh's value of the electrochemical equivalent, and Kahle's, and Carhart and Guthe's value for the Clark cell, the authors' value of the calorie at 20° coincides with that of Rowland (4.181 joules). The following values of it at different temperatures are deduced by the authors from their measurements, which were made at temperatures between 0° and 86°:

10°	4.190	30°	4.176	70°	4.188
15°	4.185	40°	4.174	80°	4.195
20°	4.181	50°	4.176	90°	4.203
25°	4.178	60°	4.181	100°	4.212

The minimum value lies at about 40°. Below 10° the value increases very rapidly, becoming about 4.23 at the freezing-point.

On the Temperature of the Acetylene Flame. By EDWARD L. NICHOLS. *Phys. Rev.*, **10**, 234–252.—By using thermo-electric junctions of varying cross-section and extrapolating for zero cross-section, the author finds the maximum temperature in the acetylene flame to be about 1900°, in the flat luminous flame of illuminating gas, 1780°, and in acandle flame, 1670°, the melting-point of pure platinum being taken as 1775°.

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On the Gas Thermometer at High Temperatures. By Ludwig Holborn and Arthur L. Day. *Am. J. Sci.*, **160**, 171–206.—With reference to high-temperature thermometry, the authors have determined the expansion from 250°–1000° of pure platinum, of a platinum-iridium alloy with 20 per cent. iridium, and of Berlin porcelain; have compared up to 1100° a platinum—platinum-rhodium thermo-element with a nitrogen thermometer having a platinum-iridium bulb; have calculated from this comparison and their previous measurements the relation between electromotive force and temperature for this and four other thermo-elements composed of various platinum metals; and have determined the melting-points of eight metals either by the "wire method," in which a short wire of the metal to be melted is introduced into the hot junction of the thermo-element itself and the electromotive force observed when the metal melts and interrupts the circuit, or by the more exact "crucible method," in which a larger quantity of the metal is melted in a crucible, and the thermo-element, protected by porcelain tubes, is inserted. The crucible method was used, either alone or with the wire method, in all cases except that of gold. The following melting-points, referred to the nitrogen thermometer, were obtained:

Cadmium	321.7°	Aluminum	657°
Lead	326.9	Silver	961.5
Zinc	419.0	Gold	1064.0
Antimony	630.6	Copper	1084.1

When melted in the air, both silver and copper gave lower values (955° and 1064.9°). The absolute accuracy (estimated at 1° up to 1150°) and the causes of variation of thermoelectric measurements are discussed.

On the Melting-point of Gold. By Ludwig Holborn and Arthur L. Day. *Am. J. Sci.*, **161**, 145–148.—The authors have confirmed with a new sample of gold both by the "wire method" and the "crucible method" (see preceding review) their previous result (1064.0) obtained by the wire method alone. The crucible method gave 1063.5° and the wire method 1063.9°.

Reaction Velocity. By Robert Hart Bradbury. *J. Franklin Inst.*, **147**, 463–474; **148**, 65–74.—In these articles is given a clear presentation of the most important principles relating to the velocity of the chemical reactions. They contain nothing original.

The Spectra of Hydrogen and the Spectrum of Aqueous Vapor. By John Trowbridge. *Am. J. Sci.*, **160**, 222–230.—Experiments with very powerful condenser discharges have led the author to believe that the four-line spectrum of hydrogen is really due to aqueous vapor, which is liberated by such discharges from the glass walls of even the most carefully dried tubes.

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On the Arc-Spectra of Elements of the Platinum Group. By H. KAYSER. *Astrophys. J.*, 7, 93–113; 173–197. **Arc-Spectra of Vanadium, Zirconium, and Lanthanum.** By HENRY A. ROWLAND AND CALEB N. HARRISON. *Astrophys. J.*, 7, 273–294, 373–389. **I. On the Series Spectra of Oxygen, Sulphur, and Selenium. II. On the Compound Triplets in the Line Spectrum of Mercury.** By C. RUNGE AND F. PASCHEN. *Astrophys. J.*, 8, 70–101; 13, 49–51. **A Determination of the Wave Lengths of the Principle Lines in the Spectrum of Gallium.** By W. N. HARTLEY AND HUGH RAMAGE. *Astrophys. J.*, 9, 214–220. **The Present Status of Kirchhoff's Law.** By A. COTTON. *Astrophys. J.*, 9, 237–268. **I. On the Red End of the Red Argon Spectrum. II. On the Spectra of Krypton. III. On the Spectrum of Radium.** By C. RUNGE. *Astrophys. J.*, 9, 281–283; 10, 73–79; 12, 1–3. **The Effect of Certain Impurities on the Spectra of Some Gases.** By PERCIVAL LEWIS. *Astrophys. J.*, 10, 137–163; 12, 16–23. **On the Effect of Pressure upon the Wave Lengths of the Lines of the Hydrogen Spectrum.** By J. WILSING. *Astrophys. J.*, 10, 269–271. **The Arc Spectrum of Vanadium.** By B. HASSELBERG. *Astrophys. J.*, 10, 343–361; 11, 67–88. **A Second Spectrum of Hydrogen beyond Wave Length 185 $\mu\mu$.** By VICTOR SCHUMANN. *Astrophys. J.*, 11, 312–313. **Note on the Spectrum of Silicon.** By FRANZ EXNER AND EDUARD HASCHEK. *Astrophys. J.*, 12, 48–49. **The Spectra of Mercury.** By WILLIAM B. HUFF. *Astrophys. J.*, 12, 103–119. **Standard Lines in the Arc Spectrum of Iron.** By H. KAYSER. *Astrophys. J.*, 12, 329–335. **The Spectrum of Hydrogen Given by the Metallic Arc of Tin, Copper, Silver, Etc.** By O. H. BASQUIN. *Astrophys. J.*, 14, 1–16. **The Absorption Spectrum of Chlorine.** By ELIZABETH R. LAIRD. *Astrophys. J.*, 14, 85–115.—The foregoing list of titles and references will serve to call the attention of those interested in spectroscopic work to the many articles upon that subject published in the *Astrophysical Journal.*

H. M. GOODWIN, REVIEWER.

An Hermetically Sealed Type of Clark Standard Cell. By H. T. BARNES. *Phys. Rev.*, 10, 268–276.—The details of the construction of an hermetically sealed Clark cell are described. The type is that known as the (English) "Board of Trade Crystal Cell." The advantages claimed are the absence of diffusion-lag and greater sensitiveness to temperature changes on account of its small size. The construction permits of its being directly immersed in a thermostat. Between 0° and 30° the following formula was found to express its electromotive force (E) in millivolts:

$$E_t = E_{15} - 1.200\ (t-15) - 0.0062\ (t-15)^2.$$

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This agrees very well with the formula given by Jäger and Kahle.

$$E_t = E_{15} - 1.19\,(t - 15) - 0.007\,(t - 15)^2.$$

The Various Determinations of the E. M. F. of the Clark Cell. By HENRY S. CARHART. *Phys. Rev.*, **12**, 129–136.—The author reviews the various determinations of the electromotive force of the Clark cell from Latimer Clark's first determination in 1872 down to the recent determinations made by himself at the Reichsanstalt. The following table contains the results of all important determinations of this quantity reduced to common terms and 15° :

Observer.	Date.	Method.	Result.
Clark	1872	Absolute	1 4378
Carhart	1882	Silver voltameter	1.4329
Rayleigh	1884	Absolute	1.4345
Ettinghausen	1884	Silver voltameter	1.434
Glazebrook and Skinner	1892	Silver voltameter	1.4344
Kahle	1896	Absolute	1.4322
Jaeger and Kahle	1898	Silver voltameter	1.4328
" " "	1899	Silver voltameter	1.4329
Carhart and Guthe	1899	Absolute	1.4333

Omitting Clark's determination, as his cells are not strictly comparable with the others on account of the use of boiled solutions of zinc and mercurous sulphate, the mean of the remaining three absolute determinations is 1.4333 volts at 15°. From this it would appear that the electromotive force of the Clark cell at 15° is nearer 1.433 volts than 1.434 volts.

The Effect of Gravity and Pressure on Electrolytic Action. By ROLLA R. RAMSEY. *Phys. Rev.*, **13**, 1–31.—When a metal is transferred electrolytically from anode to cathode, the work done is different when the transfer takes place vertically upward against gravity than when the electrodes are placed horizontally. If, therefore, an electrolytic cell, in which a current is flowing, be suddenly rotated from a horizontal to a vertical position, a counter electromotive force should be developed, as was first pointed out by Maxwell in 1878. This prediction was later verified by experiments of the electrolysis of chlorides of the metallic earths. These experiments are reviewed in an introductory historical summary. The original experiments described in this paper are on the effect of gravity on the electromotive force during the electrolysis of zinc or cadmium sulphate solutions. With a 10 per cent. zinc sulphate solution the electromotive force of polarization was found to be negative, so that the resulting current flowed up the tube opposite to gravity. This result is in agreement with theory, for when 32.5 grams of zinc are carried up with the current, 57.7 grams of SO_4 are carried down to the opposite electrode, and the electromotive force observed is due to

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the excess of the mass of the SO_4 over that of the zinc. The results obtained with cadmium sulphate solutions were more concordant than those with zinc solutions. With a 10 per cent. solution the electromotive force per centimeter of height was -1.75×10^{-8} volts; with a 46 per cent. (nearly saturated) solution the observed value per centimeter of height was $+4.78 \times 10^{-8}$ volts. The effect of pressure on the electromotive force of various cells (the Clark, cadmium, calomel, and others) was also studied by connecting two similar cells in opposition and varying the pressure in one of them, even up to 300 atmospheres. In general, the observed electromotive force of the combination increased linearly with the pressure; but a copper sulphate cell and an old (black) silver chloride cell were exceptions, the electromotive force of the former diminishing slightly with the pressure, while that of the latter at first increased very rapidly, and afterwards diminished.

A New Solution for the Copper Voltameter. By WILLIAM K. SHEPARD. *Am. J. Sci.*, **162**, 49–56.—In order to increase the limits between which the current density may be varied in a copper voltameter, the author has investigated the effect of the addition of a small per cent. of ammonium chloride to the copper sulphate solution, the presence of this salt in a copper nitrate solution having been found by Beach to increase considerably the limits between which it could be used. The solution was prepared as follows: A saturated copper sulphate solution was boiled for a short time and then maintained at 100°, for about an hour, in contact with metallic copper, in order to neutralize the solution. About 0.05 per cent. of ammonium chloride was then added. Experiments with this solution showed that deposits reliable to 0.1 per cent. could be obtained with current densities varying from 2 amperes to 7 amperes per square decimeter, and at temperatures from 20° to 40°.

Polarization and Internal Resistance of Electrolytic Cells. By MARTIN D. ATKINS. *Phys. Rev.*, **13**, 102–125, 182–192.—The object of this investigation was to test the applicability of Wiedeburg's theory of polarization to various electrolytic cells. The two principal problems investigated were the effect of current on the apparent change of internal resistance of a cell and the closeness with which the formulæ derived from Wiedeburg's theory represented these experimental results. The apparatus was so arranged that, by means of a series of contacts operated by a pendulum, a current was caused to flow through an electrolytic cell and a known resistance, and the potential around each of these in succession was caused to charge a condenser which was immediately after discharged through a ballistic galvanometer. The apparent internal resistance of the cell was then compared with the values calculated from the theory. The principal re-

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sults of the investigation may be summarized as follows: 1. Electrodes of copper in copper sulphate and zinc (as amalgamated plates or as liquid amalgam) in zinc sulphate gave, with varying currents, results in complete agreement with a formula of the Bartoli-Wiedeburg form, when they were *first* placed in their solutions. The internal resistance of these cells is therefore constant in accordance with the assumptions of the theory. 2. Electrodes of silver in silver nitrate and zinc (not amalgamated) in zinc sulphate also show, on the whole, a satisfactory agreement with the theory. 3. Polished platinum electrodes in sulphuric acid do not agree with the requirements of the theory. 4. All of these electrodes, in their respective solutions, show a very marked rise in the apparent resistance on standing, but the results do not indicate that this is an increase of the real resistance of the cell. 5. The experiments made to test the effect of the size of the electrodes and time of flow of current in the cell on the constants of Wiedeburg's formula do not confirm the theory, although an equation of the general form of that proposed seems to satisfy best the curves obtained for the internal resistance and polarization of the cells investigated.

Secondary Reactions in Electrolysis. By JOSEPH W. RICHARDS. *J. Franklin Inst.*, **152**, 201–225.—The purpose of this paper is a classification of the numerous types of secondary reactions occurring in electrolysis and the calculation of the voltage necessary to effect decomposition in any given case. All these calculations are based on the application of the so-called Law of Thomson to the thermochemical data corresponding to the formation of the final products of the electrolysis. The author's classification of secondary reactions is practically the same as that given by Ostwald, with additional sub-divisions. It is as follows: (1) The ions polymerize into more complex forms; (2) The ions decompose or dissociate into simpler forms; (3) The ions react with the electrodes; (4) The ions react with the electrolyte. Group (3) is further subdivided into reactions at the anode, and reactions at the cathode; in either case the electrode may be a solid or a liquid; and the resulting secondary product may be (*a*) a gas, (*b*) a liquid, or (*c*) a solid, and may be either soluble or insoluble in the electrolyte. Similarly, under group (4) are considered all the different possibilities in regard to the nature of the products of oxidizing actions at the anode, and reducing actions at the cathode. Numerous excellent examples are given to illustrate each group of the above classification.

Electrochemical Action. By C. J. REED. *J. Franklin Inst.*, **151**, 369–393, 401–413; **152**, 46–58.—In these articles the author sets forth at length his views regarding the theory of the electrochemical action in primary batteries and decomposition cells, of

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polarization, and of the nature of electrolytic conduction. He does not consider the assumption of the existence of free ions, Arrhenius' Dissociation Theory, or even the conception of the migration of ions during electrolysis, at all necessary to explain any of the known electrochemical phenomena. The substitute which he offers is a modified form of the time-honored Grotthus' chain hypothesis, for the details of which the reader is referred to the original articles.

Thermodynamics of the Voltaic Cell. By HENRY S. CARHART. *Phys. Rev.*, 11, 1–13.—The author gives a deduction of the Gibbs–Helmholtz formula for the electromotive force of a voltaic cell in terms of the separate temperature coefficients of the two electrodes, instead of in terms of the resultant temperature-coefficient of the cell. The formula was tested by following, by means of thermal couples of iron and constantan wire, the temperature-changes produced in the solutions surrounding the electrodes of a Daniell cell. The two halves of the cell were exactly similar and were separated by a plate of fine unglazed porcelain. The difference of temperature per second, as indicated by the junctions, was found to be proportional to the current, as theory required, and the observed value agreed well with that calculated from thermochemical data and the heat capacity of the cell.

The Electromotive Force of Metals in Cyanide Solutions. By S. B. CHRISTY. *Trans. Am. Inst. Min. Eng.*, 30, 864–946.—The first twenty-six pages of this article are devoted to an excellent condensed statement of Nernst's theory of the voltaic cell, and of the theory of solutions and electrolytic dissociation on which the theory is based. The reason why the arrangement of the metals in a voltaic series differs with the nature of the solution with which they are in contact is explained. Particular attention is devoted to the case of cyanide solutions, in which the ions of the heavy metals cease to exist as such except in minute quantities, being held in combination as a part of a complex anion. The experimental part of the paper contains the results of measurements of the absolute potential difference between a large number of metals in contact with potassium cyanide solutions of concentrations varying from normal to millionth normal. The potentials were measured by means of an Ostwald normal electrode; a Wiedemann galvanometer was used as measuring instrument, both the deflection and Poggendorf compensation method being employed. The results are discussed graphically, first by the direct method, *i. e.*, plotting potential differences as ordinates and concentrations as abscissae, and second by the logarithmic method, that is, with potential differences as ordinates and logarithms of the concentration as abscissae. By Nernst's theory the absolute potential difference (π) between a metal and a solution is given by the formula:

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$$\pi = \text{const. } ln \frac{P_M}{p} = \text{const.} - \text{const. } ln\ p,$$

where p, the osmotic pressure of the kation, is proportional to its concentration (c); hence it follows that if π is plotted as ordinates and $ln\ p$, or its proportional quantity $ln\ c$, as abscissae that the points should lie along a straight line. The metals zinc, copper, gold, silver, lead, mercury, and iron were investigated, and the results discussed in conjuction with those of von Oettingen. In general, the potential decreased with increasing dilution, according to the logarithmic formula up to dilutions of 1,000 to 10,000 liters. Beyond this dilution the potential decreased very much less rapidly. The order of the metals in normal cyanide solutions was found to be zinc, copper, gold, silver, lead, mercury, iron. In very dilute solutions the order became zinc, lead, iron, copper, silver, gold, mercury. The last part of the paper is devoted to a consideration of the question of the variation of the solvent power of cyanide solutions for gold, with the concentration, and with the amount of air or oxygen dissolved. Experiments on the solubility of similar gold strips rotated twenty-four hours under like conditions in cyanide solutions of various strengths showed no appreciable solvent action when the solution contained less than 0.001 per cent. The solubility increased rapidly at concentrations greater than 0.0005 normal. The same was true when a large amount of air was present in the bottles containing the metal and solution. Experiments show that the solvent action of the cyanide is unquestionably increased by the presence of dissolved oxygen, and that the reason why the solvent action becomes a maximum in a 5 to 10 per cent. solution is, that at this concentration the combined effects of the dissolved oxygen, and of the potential difference between the metal and the solution attains its greatest value. The effect of the presence of hydrogen peroxide in solution was also studied. The experiments described suggest several interesting lines of work for further investigation.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Potassium Perselenate—Preliminary Note. BY L. M. DENNIS AND O. W. BROWN. *J. Am. Chem. Soc.*, **23**, 358–359.—Potassium perselenate was prepared by the electrolysis of a cold saturated solution of potassium selenate containing free selenic acid. The product separates upon the anode as a white powder. When hot, potassium perselenate oxidizes manganese dioxide to potassium permanganate, and oxidizes thallous and ferrous sulphate in the cold.

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The Reaction between Chlorine and Ammonia. By WILLIAM A. NOYES AND ALBERT C. LYON. *J. Am. Chem. Soc.*, **23**, 460–463.—The authors have shown by quantitative experiments that the reaction between chlorine and ammonia takes place according to the reaction : $12NH_3 + 6Cl_2 = N_2 + NCl_3 + 9NH_4Cl$, when the ammonia is used very nearly in the proportion indicated. If an excess of ammonia is used it reacts with the nitrogen trichloride, giving free nitrogen and ammonium hypochlorite.

On the Decomposition of Sodium Nitrate by Sulphuric Acid, II. By C. W. VOLNEY. *J. Am. Chem. Soc.*, **23**, 489–492.—The author considers that the reaction between sulphuric acid and sodium nitrate takes place in two phases. The first takes place below 100°, according to the reaction :

$$NaNO_3 + 2H_2SO_4 = NaH_3(SO_4)_2 + HNO_3 ;$$

on raising the temperature the second phase takes place according to this reaction :

$$NaH_3(SO_4)_2 + NaNO_3 = NaH(SO_4)_2 + HNO_3.$$

The Sulphohalides of Lead. By VICTOR LENHER. *J. Am. Chem. Soc.*, **23**, 680–682.—The sulphohalides of lead are readily prepared by dissolving lead sulphide in the halogen acid and diluting this solution with water. The chlor- and bromsulphide separate immediately as red precipitates. An excess of water converts this precipitate into black lead sulphide.

The Crystallization of Copper Sulphate. By ARTHUR JOHN HOPKINS. *Am. Chem. J.*, **25**, 413–419.—In the preparation of crystals of copper sulphate from 20–30 mm. in length, the author was guided by the following principles : I. In the process of crystallizing copper sulphate, at constant room temperature, the solubility is a constant and the concentration, minus this constant, is the total weight of crystal deposit. II. (*a*) In a solution, supersaturated in absolute quiet, no crystals will form. (*b*) In a solution supersaturated in absolute quiet, the number of crystal points formed by the first disturbance is the same as the number of crystals formed. (*c*) The ratio between the number of crystals formed and the weight of crystal deposit determines the size of the crystals. III. For a given volume of solution and given size of crystals and weight of crystal deposit, the diameter of the crystallizing dish determines the space between the crystals. Experiments showed that the best conditions were obtained when 171 grams of copper sulphate were dissolved in water and 15 cc. of normal sulphuric acid, and the whole evaporated to less than 340 cc., and then diluted to exactly that volume with boiling water. As the ratio of the volume of solution to the horizontal surface of the crystallizing dish is identical with the depth of solution, a dish 26 cm. in diameter was selected so as to have a depth of

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liquid of 6.3 mm. for the above concentration. In order to obtain the proper number of crystal points, a blast of air was blown on the surface of the solution until the desired number of crystals were started. The dish was then allowed to stand at constant temperature over night. On crystallization at 23°, 275 cc. of mother-liquor and 78 grams of crystals, 20–30 mm. in length, were obtained. In order to concentrate the mother-liquor to such a volume as to produce a proportionate crop of crystals, it was calculated that any saturated solution of copper sulphate must be evaporated to 67.1 per cent. of its volume.

On the Formation of Platinum Tetrachloride from Aqueous Hydrochloric Acid by Atmospheric Oxidation in Contact with Platinum Black. By J. W. MALLET. *Am. Chem. J.*, **25**, 430. —It was found that when platinum black was washed with a fairly strong aqueous solution of hydrochloric acid it was dissolved to a small extent with the formation of platinum tetrachloride.

On the Purification of Caesium Material. By H. L. WELLS. *Am. Chem. J.*, **26**, 265–268.—The use of the double salt, $2CsCl.PbCl_4$, has been found very convenient for the separation of caesium, particularly after a large part of the caesium has been removed by some other means. To accomplish this, the author separates the greater portion in the form of the salt $3CsCl.2SbCl_3$, as recommended by Godeffroy, except that a much less concentrated hydrochloric acid is used. The filtrate then carries a small amount of caesium, which is precipitated as $2CsCl.PbCl_4$ when 2 or 3 grams of lead nitrate per liter are added, and the solution is saturated with chlorine gas. The caesium in the antimony double salt is recovered by treating the salt with boiling dilute ammonium hydroxide. In the filtrate from the antimonious hydroxide, the large amount of ammonium chloride is removed by several evaporations with strong nitric acid. The caesium nitrate can be further purified by recrystallization, or by dissolving the nitrate and an equivalent weight of iodine in 10 parts of 1 : 1 hydrochloric acid at a temperature just below boiling. On cooling, the salt $CsCl_2I$ separates, practically free from rubidium, lithium, sodium, and potassium.

On a Salt of Quadrivalent Antimony. By H. L. WELLS AND F. J. METZGER. *Am. Chem. J.*, **26**, 268–271.—The double salt $2CsCl.SbCl_4$, which had been previously made by Setterberg by boiling a solution of antimony trichloride in strong hydrochloric acid, with antimony pentachloride and caesium chloride in excess, was found to be isomorphous with the salt $2CsCl.PbCl_4$. The color of the octahedral crystals is black, but the powdered crystal is dark blue.

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On the Acid Nitrates. By H. L. Wells and F. J. Metzger. *Am. Chem. J.*, **26**, 271–275.—In addition to the acid nitrates described by Ditte, the authors have prepared and studied the properties of the new salts, $RbNO_3.HNO_3$, $RbNO_3.2HNO_3$, $CsNO_3.HNO_3$, $CsNO_3.2HNO_3$, $TlNO_3.2HNO_3$. The monacid salts are readily prepared by saturating nitric acid, of sp. gr. 1.42, with the normal nitrates at a gentle heat and cooling till crystallization occurs. For the diacid salts, it was necessary to use nitric acid of 1.50 sp. gr. and to cool in a freezing-mixture.

Investigations on Double Nitrates. By H. L. Wells, H. P. Beardsley, G. S. Jameson, and F. J. Metzger. *Am. Chem. J.*, **26**, 275–278.—It was found impossible to prepare double nitrates of caesium and the bivalent metals; but with ferric nitrate, caesium nitrate forms a yellow deliquescent salt, melting at 33°–36°, having the composition represented by the formula $Cs.NO_3.Fe(NO_3)_3.7H_2O$, and with bismuth nitrate, colorless, prismatic crystals of caesium bismuth nitrate, $2CsNO_3.Bi(NO_3)_3$, were obtained by evaporating a nitric acid solution of the two nitrates. When thallous nitrate is dissolved in concentrated nitric acid by the aid of heat a part of the salt is oxidized, and a thallous thallic nitrate of the composition $2TlNO_3.Tl(NO_3)_3$ separates on cooling.

On Caesium Periodate and Iodate-Periodate. By H. L. Wells. *Am. Chem. J.*, **26**, 278–281.—Caesium periodate was formed by adding caesium carbonate to a concentrated solution of periodic acid. There was no evidence of the formation of any other than the normal periodate. By dissolving caesium iodate and periodate in dilute periodic acid, the iodate-periodate, $HCsIO_3.IO_4.2H_2O$, crystallizes out in white prisms on evaporation.

On the Caesium-Antimonious Fluorides and Some Other Double Halides of Antimony. By H. L. Wells and F. J. Metzger. *Am. J. Sci.*, **161**, 451–456.—By bringing together solutions of antimonious fluoride and caesium fluoride with some free hydrofluoric acid in varying proportions the following double salts were isolated: $CsF.3SbF_3$, $CsF.2SbF_3$, $4CsF.7SbF_3$, $CsF.SbF_3$, $2CsF.SbF_3$. The 3 : 2 type of salt has not been made, and this seems the more remarkable since this type is prominent among the chlorides, bromides, and iodides. The 1 : 3 and 4 : 7 type of caesium antimonious fluoride salts are not found among the other double halide salts, and the 3 : 4, 3 : 2, 7 : 3, 3 : 1, and 4 : 1 types have not been found for the double fluorides. Caesium-antimonious iodide, $3CsI.2SbI_3$, has been found to exist in a brick-red, octahedral form, and in yellow, hexagonal plates. The octahedral salt separates from solutions strongly acidified with hydriodic acid and the hexagonal salt from weakly acidified solutions. The composition of Setterberg's double chloride, CsCl.

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$SbCl_5$, has been confirmed, but the corresponding double fluoride does not seem to exist. The only double fluoride of caesium and quinquivalent antimony which has been found is the one having the composition represented by the formula $CsF.SbF_4OH$.

On a Caesium-Tellurium Fluoride. By H. L. Wells and J. M. Willis. *Am. J. Sci.*, **162**, 190.—Under the widest range of conditions only one double fluoride of caesium and tellurium could be prepared. The salt, $CsF.TeF_4$, crystallizes in large transparent, colorless needles, and is readily decomposed by water.

On the Double Chlorides of Caesium and Thorium. By H. L. Wells and J. M. Willis. *Am. J. Sci.*, **162**, 191–192.—On bringing together thorium and caesium chlorides in varying proportions, two new salts, $3CsCl.ThCl_4.12H_2O$ and $2CsCl.ThCl_4.11H_2O$, were prepared. Attempts to prepare the double fluorides were not successful on account of the great insolubility of thorium fluoride.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

The Composition of a Wood Oil. By G. S. Fraps. *Am. Chem. J.*, **25**, 26–53.—The material used in the investigation was obtained from a hard-wood tar. The tar, after distillation, was treated with caustic potash and again distilled. The distillate so obtained, which boiled from 54° to 210°, was fractionated into portions which were collected at intervals of 5°. As a result of a careful investigation of the separate fractions, the following conclusions are drawn: The oil probably contains the series of aldehydes $C_nH_{2n}O$ up to caproic aldehyde. The quantity of these compounds is so small, however, that valeric aldehyde only was positively identified. Furfural is also present in small quantity. The following ketones were detected in the oil: dimethyl-, methylethyl-, methylpropyl-, and probably methyl-*n*-butyl- and diethyl ketones. Cyclopentanone and other ring ketones are also present. It contains nitriles in minute quantities and the methyl esters of acetic, propionic, *n*-butyric, and *n*-valerianic acids. Methyl caproate, heptoate, and isobutyrate are also probably present. Esters of unsaturated acids, which were not identified, were also found. The oil contains methyl-, dimethyl-, trimethyl-, and higher furanes. No dimethylacetal or appreciable quantities of pyridines or alcohols were discovered. Unsaturated compounds which unite with hydrochloric acid and bromine were shown to be present. The oil contains toluene and xylene, and probably cumene and cymene. It also contains creosote and minute quantities of phenol ethers. The higher-boiling oil, freed from ke-

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tones, aldehydes, ethereal salts, and phenols, was separated into two parts by glacial acetic acid, the one soluble and the other insoluble. Both parts absorbed bromine readily.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

F. J. MOORE, REVIEWER.

The Occlusion of Magnesic Oxalate by Calcic Oxalate and the Solubility of Calcic Oxalate. BY THEODORE W. RICHARDS, CHARLES F. MCCAFFREY, AND HAROLD BISBEE. *Proc. Am. Acad.*, 36, 377–393.—The authors sum up the results of their work as follows: "(1) All those conditions which tend to diminish the amount of undissociated magnesic oxalate in a solution tend to diminish the amount of this impurity in calcic oxalate precipitated from the solution. (2) Hence evidence is furnished supporting the hypothesis that occlusion is a distribution of an undissociated substance between the liquid and the "nascent" solid phase. (3) Magnesic oxalate is precipitated upon the calcic oxalate after this is deposited, although far more slowly than while it is being deposited. For this reason the filtration should be not too long delayed. (4) Calcic oxalate is sufficiently soluble in pure water to cause grave inaccuracies in precise quantitative work. (5) This solubility may be diminished, but not wholly prevented, by an excess of ammonic oxalate in the wash-water. (6) By heeding all these relations, a reasonably precise separation of magnesium and calcium may be made in a single precipitation. The details are as follows: The magnesium in the solution should be not much stronger than fiftieth-normal. About ten times the equivalent amount of ammonic chloride, and enough oxalic acid to combine with all the calcium, should be added to the mixed solution. It is well to diminish the dissociation of the oxalic acid beforehand by the addition of two or three times its equivalent amount of hydrochloric acid. To the boiling mixture, colored with a drop of methyl orange, should be added slowly a very dilute solution of ammonia, with continual stirring and occasional pauses. The final stages of neutralization should not be reached in less than half an hour. When the neutralization has been effected, a very large excess of ammonic oxalate should be added, and the mixture should be allowed to stand for four hours. The precipitated calcic oxalate should be thoroughly washed with water containing ammonic oxalate. The filtrate will contain all but about 0.1 or 0.2 per cent. of the magnesium, and the precipitate will contain all but about the same proportion of the calcium. (7) The precipitate, having been formed slowly from a solution in which it was somewhat soluble, is distinctly crystalline and far more easily handled than if it had been suddenly precipitated.

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This is a general effect, which might render service in other cases."

Bismuth Assay. By A. W. Warwick and T. D. Kyle. *Eng. Min. J.*, 71, 459.—About 1 gram of "pulp" is treated with 5 to 10 cc. of concentrated nitric acid, and the solution evaporated to dryness on the hot plate. The residue is made up to about 100 cc. with boiling water. Five grams of ammonium oxalate are then added, and the whole is boiled vigorously for five minutes. The supernatant liquid is now decanted off, and the precipitated bismuth oxalate is changed to the basic compound by boiling with two successive portions of pure water of about 50 cc. each. The basic oxalate is now dissolved on the filter in about 5 cc. of warm dilute hydrochloric acid, the acid neutralized by ammonia, and then an excess of sulphuric acid added. The liberated oxalic acid may now be titrated with permanganate. The ammonia is added because the titration in hydrochloric acid solution gave a poor end-point, while the direct solution of the oxalate in sulphuric acid was impracticable on account of the time required. The whole process can be carried out within forty minutes, and yields results concordant within 0.1 per cent. The presence of lead, copper, zinc, arsenic, or tellurium does not interfere with the results.

The Electrolytic Determination of Copper. By Thorn Smith. *Eng. Min. J.*, 71, 659–660.—The author considers the electrolytic method superior to most of the volumetric methods in common use for commercial purposes, and the article is mostly devoted to showing how successful determinations can be made in a "works" laboratory without the aid of expensive apparatus and appliances. He shows, in brief outline, how different ores should be prepared for electrolysis.

Sampling Pig Iron. By Harrison Everett Ashley. *Foundry*, 18, 108–109.—The author criticizes articles by Scott and Field upon the same subject, and shows in much detail where he thinks borings should be made in a pig, in order to obtain a fair sample. The ideas presented are illustrated by elaborate diagrams.

Contributions to the Knowledge of Reversible Reactions. By W. N. Stull. *J. Am. Chem. Soc.*, 23, 508–514.—The author studies the action of hydrogen sulphide upon solutions of zinc and cadmium in hydrochloric and sulphuric acids. The results of his work, as far as they have a bearing upon chemical analysis, seem to show that a more complete separation of cadmium from zinc can be effected in sulphuric than in hydrochloric acid solution. An interesting detail in this connection is the fact that while cadmium sulphide is appreciably soluble in dilute sulphuric acid, even

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in the cold, yet it may be rendered almost completely insoluble in this medium by keeping the liquid saturated with hydrogen sulphide.

Estimation of Hydrate in the Presence of Alkali Carbonate. By W. E. Ridenour. *J. Franklin Inst.*, **152**, 119–121.—The author tests the method of P. T. Thompson (Sutton's "Volumetric Analysis," 5th edition), and finds that when phenolphthalein is used as an indicator, it does not show half the carbonate under any circumstances. A definite ratio exists, however, between the amount actually present and that indicated by the titration. Correct results may therefore be obtained by the introduction of an arbitrary factor into the calculations.

Micro-Chemical Analysis. By E. M. Chamot. *J. Applied Microscopy*, **2**, 502–505; **3**, 719–723, 793–796, 817–824, 849–859, 965–969, 981–986, 1045–1051, 1077–1083; **4**, 1121–1128, 1189–1194, 1242–1249, 1289–1297, 1323–1330, 1373–1379, 1451–1458, 1495–1499, 1529–1533.—The above references are to a long series of papers now appearing in the journal mentioned. The treatment of the subject is adapted to the use of the beginner in chemical work with the microscope. Detailed directions for the ordinary manipulations are followed by a description of the characteristic reactions of the various elements, and the whole is illustrated by adequate cuts and diagrams. The reviewer has found many of the suggestions of much assistance in his own work, and it is hoped that the material presented in this series of articles may later be published in the form of a laboratory manual. A work of this kind is much needed in this interesting, though hitherto much neglected, field of analytical chemistry.

PROXIMATE ANALYSIS.

A. H. Gill, Reviewer.

The Accuracy of Carbonic Acid Determinations by the Arndt Gravity Econometer. By A. Bement. *Sibley J. Mech. Eng.*, **15**, 239–244.—The results show that the average of the readings of the instrument agree with the analyses. It does not, however, follow sudden fluctuations in the chimney gases.

Oil of Walnuts. By L. F. Kebler. *J. Franklin Inst.*, **151**, 394–395.—The examination of two commercial samples showed one to be dilute glycerine flavored with a menthol-like body, the other to be a mixture mainly of alcohol and nitrobenzene. The oil expressed from walnut-kernels had a specific gravity at 15° of 0.926, a saponification number of 186–197, an iodine value of 142–152, and a melting-point of the fatty acids of 16°–20°. It is said to be imported from France and Switzerland in 110 gallon tuns, and to be equal, if not superior, to linseed oil in drying qualities.

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The Chemistry of Corn Oil. By H. T. Vulté and H. W. Gibson. *J. Am. Chem. Soc.*, **22**, 453–467.—The following constants were found as a result of closely agreeing determinations on three different samples.

Sp. gr. 15 5°.	Iodine value.	Saponification value.	Hehner value.
0.921–0.9255	113.3–119.7	191.5–193.7	88.1–93.2
Reichert value.	**Acetyl value.**	**Maumené test.**	**Valenta test.**
4.0–10.1	10.7–11.8	74°–75°	44°–74°

Phytosterol, or rather the unsaponifiable matter, amounted to 1.4 per cent. A dark brown coloration is produced by Bechi's test and an intense black by Brullé's test.

The Nature and Properties of Corn Oil. II. Determination of its Constitution. By H. T. Vulté and H. W. Gibson. *J. Am. Chem. Soc.*, **23**, 1–8. Stearic, palmitic, oleic, linolic, ricinoleic, formic, and probably caproic, caprylic, and capric acids had been previously found in corn oil. The presence in it also of acetic, hypogaeic, and arachidic acids was proved by this investigation. That of formic acid was also confirmed. The Reichert value is the highest of any seed oil, being about 4.2. The nature of the volatile oil was not considered.

A Comparison between the Bromine and Iodine Absorption Figures of Various Oils. By H. T. Vulté and L. Logan. *J. Am. Chem. Soc.*, **23**, 156–159.—The work is intended as a revision of the existing tables of these constants and has been carefully carried out, as is shown by the close agreement of the duplicates. It is difficult to see why twenty-four hours was chosen as the time for action of the iodine solution, when the usual practice is from two to four hours. Olive, cotton-seed, poppy-seed, linseed, almond, peanut, whale, lard, sperm, rape, castor, seal, cod-liver, menhaden, and resin oils were examined.

On the Heat of Combustion as a Factor in the Analytical Examination of Oils; and the Heats of Combustion of Some Commercial Oils. By H. C. Sherman and J. F. Snell. *J. Am. Chem. Soc.*, **23**, 164–173.—The article gives a résumé of the work done on the calorific value of oils and a description of the method employed. The calorimeter used was of the Atwater-Blakeslee type, the oil being absorbed upon fibrous asbestos and fired by an electrically-fused iron wire. The calorific power at constant volume of most of the oils is about 9400; that of boiled linseed and castor oils is 8800, and those of resin oil and petroleum are from 10,100 to 10,700 cal. The specific gravity, iodine number, and free-acid content are also given. It would hardly seem practicable to use the method as a means of detecting the adulteration of oils.

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The Quantitative Estimation of Hydrogen Sulphide in Illuminating Gas. By C. C. TUTWILER. *J. Am. Chem. Soc.*, **23**, 173–177.—The estimation is effected by means of a Bunte burette containing the gas, in which the hydrogen sulphide is estimated by iodine solution run in from a 10 cc. burette attached to the top of the gas burette. Mercury is used as the confining liquid and to draw in the iodine solution. The apparatus is easily manipulated and accurate and should find extensive application in gas works.

The Determination of Hydrogen in Gas Mixtures. By F. C. PHILLIPS. *J. Am. Chem. Soc.*, **23**, 354–356.—This determination is effected by combustion with air by means of palladized asbestos, which is contained in a U-tube 3 mm. in diameter and 70 cm. in total length. Difficulty having been experienced in maintaining a uniform temperature, the tube is heated in a bright jacketed vessel, silvered to prevent radiation. It would seem that the apparatus should work well.

Gasometric Analysis. By F. X. MOERK. *Am. J. Pharm.*, **72**, 366–372.—This article deals with the estimation of spirits of nitrous ether, sodium nitrite, urea, and hydrogen dioxide by a simple apparatus, resembling that of Squibb, and charged with brine. The results upon hydrogen dioxide are a little higher than those of the U. S. pharmacopeia.

Notes on the Examination of American Oil of Peppermint for Menthol. By F. A. SIEKER. *Pharm. Rev.*, **19**, 66–67.—Attention is called to the fact that samples of oil of peppermint are condemned as not of the purity required by the pharmocopeia, simply because they are not cooled to a sufficiently low temperature (—21° C.). When this oil is rectified by steam 90 per cent. comes over, which contains one per cent. less menthol than the crude oil; a resinous residue is left after distillation, which indicates decomposition or polymerization of the oil.

On the Elimination and Quantitative Estimation of Water in Oils, Fats, and Waxes. By C. B. DAVIS. *J. Am. Chem. Soc.*, **23**, 487–488.—The process consists in exposing the substance to a temperature of 110° on a dried and weighed paper coil after the manner of the Adams' method for fat extraction in milk.

A Report upon Linseed Oil and Its Adulterations, Submitted to the Commissioner of Agriculture of New York State. By PARKER C. MCILHINEY.—This report deals very fully with the subject, the object being to ascertain first the charter of pure linseed oil as sold in New York State; second, what adulterants are used; and third, to what extent adulteration is practiced. The methods of preparation of raw and boiled oil are given, particular attention being paid to the various ways of manufacturing the

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latter, especially by the addition of driers-making "bung-hole" oil. The analytical details embrace the determination of the specific gravity, of the action of bromine or iodine on the oil, of the percentage of unsaponifiable organic matter, of the Koettstorfer and acid figures, and of the amounts of insoluble bromine derivatives, and of the volatile oils, turpentine, and benzene. The following figures were found: Specific gravity at 15.5°, 0.931–0.937 (0.931–0.950 boiled oil); bromine addition figure, 100–110; bromine substitution figure, 3–5; iodine addition figure, 178–185; per cent. unsap. org. matter, 1.1–2.5; Koettstorfer figure, 186–196; acid figure, 3.0–7.0. In addition to these there is a correction table for temperature in determining the gravity of linseed oil by the hydrometer, and analytical data are given on the adulterants of linseed oil, such as rosin, menhaden, corn, and cottonseed oils, as well as upon genuine and adulterated oils. The report bears evidence of careful preparation and should be in the hands of every one interested in the subject.

Investigation of the Halphin Color Test as to Its Value for the Detection of Cottonseed Oil. By R. D. Oilar. *Am. Chem. J.*, **24**, 355–373.—The work corroborates to a great extent that of other investigators who have used the test. It is found that old and rancid fats do not produce the reaction, which is not the case with the Bechi test. His method of procedure is as follows: Measure 10 cc. of pure amyl alcohol, pure carbon disulphide containing 1–2 per cent. fresh flowers of sulphur, and 10 cc. of the oil or melted fat into a large test-tube; heat in a water-bath until the violent boiling ceases, and finally in a salt-bath to a temperature of 105°–110° for forty-five to sixty minutes, or for two or three hours, if traces are to be detected. It is found that the test is given by none of the common edible oils and fats other than cottonseed; it is reliable with $\frac{1}{2}$ or $\frac{1}{4}$ per cent., and $\frac{1}{10}$ or even $\frac{1}{16}$ per cent. may be detected by it when compared with a blank test. It is so delicate that other oils which have been pressed in cottonseed presses will give the reaction. It can be applied to the soap or fatty acids as well as to the oil itself; it may serve also for the recognition of free sulphur. Tables are given, showing the results in detail.

G. W. Rolfe, Reviewer.

Rotation of the Plane of Polarization by Mixtures. By W. Porter Beck. *Am. J. Pharm.*, **73**, 367–373.—The author describes polariscopic measurements of sugars and oils made to determine the principles governing the optical rotation of mixtures of optically active substances. The results confirm the law that in a physical mixture of optically active substances these preserve their rotating properties independently of each other.

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ASSAYING.

H. O. HOFMAN, REVIEWER.

A Device for Sampling Pig Iron. By P. W. SHIMER. *Trans. Am. Inst. Min. Eng.*, **30**, 321–323.—The device consists of a conveniently arranged breast-drill with a ¼-inch twist bit to bore the holes, and a cup to catch the drillings.

Power Laboratory Ore Grinder. By C. B. MURRAY. *J. Am. Chem. Soc.*, **23**, 198–199.—This mechanical grinding apparatus, of which the note is an illustrated description, is used at the Edgar Thomson Steel Works. It resembles the well established Morrel agate mortar.

Notes on Some Blowpipe Tests. By J. W. RICHARDS. *J. Am. Chem. Soc.*, **23**, 213–215.—The author gives details of manipulation in the use of the blowpipe for preliminary tests which insure accurate results. The blowpipe, which is used so little in testing, gives reliable and quick results when in the hands of an expert.

The Use of Metallic Sodium in Blowpipe Analysis. By C. L. PARSONS. *J. Am. Chem. Soc.*, **23**, 159–161.—Referring to Hempel's method of using sodium as a reducing agent, the author prefers the following simpler manner of operating: a piece of sodium, 3 to 4 mm. in diameter, is flattened out, the powdered substance to be tested pressed into it with the hammer, the whole turned over with the blade of a knife, kneaded into a ball, placed upon a cavity in the charcoal and ignited, when with a flash the reduction takes place momentarily. The reductions are perfect.

The Measurement of Gold and Silver Buttons in Quantitative Blowpipe Assays. By J. W. RICHARDS. *J. Am. Chem. Soc.*, **23**, 203–212.—The author briefly outlines Harkort's invention of the quantitative blowpipe assay for silver and gold, criticizes Plattner's improvements, describes the Goldschmidt modification (remelting the button on charcoal and measuring its horizontal diameter with a microscope) and gives full details of his own method in which he adopts Goldschmidt's idea of remelting the button, whenever practicable, and measures the button by a modification of Harkort's scale.

Experiments Regarding the Influence of Silica on the Loss of Silver in Scorification. By L. STRAUSS. *Trans. Am. Inst. Min. Eng.*, **30**, 554–559.—In the work pure pyrite, zinc blende, galena, stibnite, and sulphur furnished the ores, silica and test-lead the fluxes (all were free from silver). The ores were charged with filings of silver, 0.992 fine and free from iron, and varying amounts of silica, scorified and cupelled. The results give numerical data for the known facts that the greater the amount of

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the slag, the greater the loss in silver, and that the behavior of metallic sulphides is not uniform.

The Assay of Copper Materials for Gold and Silver. By L. D. Godshall. *Trans. Am. Inst. Min. Eng.*, 30, 529–531.—The author briefly reviews the usual dry and combined dry and wet methods for assaying coppery material, and proposes the following which he deems to be more satisfactory as to results and quicker: Dissolve 0.5–0.4 A. T. ore in dilute nitric acid, using small quantities at a time, add some sulphuric acid, evaporate excess of nitric acid, cool, add cool, then hot water, and introduce hydrogen sulphide for a few minutes until all the silver with only a little copper has separated out as a flocculent precipitate which carries down all the gold and is easily filtered; now filter, and proceed in the usual way by burning filter and assaying the ashes. The filtrate must be tested for silver with a pinch of salt or a drop of hydrochloric acid. Ledoux and Whitehead discuss the paper. Ledoux (page 1122) gives the following method as being in use at present in his laboratory; Dissolve one A. T. in dilute nitric acid, boil, filter, add to filtrate sufficient salt solution to precipitate all the silver as chloride, allow to stand over night (when pressed for time, stir vigorously by hand or better by compressed air), filter, scorify silver chloride, gold and insoluble residue together, cupel, etc. With some copper materials very low in gold the "all-fire method" is more satisfactory, as gold seems to go into solution. In this method ten samples of 1/10 assay-ton each are scorified with lead until most of the copper has been removed, then united, cupelled, etc. The author tested Godshall's method comparing it with the "combination" and "all-fire" method. He obtained the following results:

Silver—Ounces Per Ton.

	Godshall method.	Combination method.
No. 1	67.70	67.20
" 2	57.20	58.80
" 3	59.00	59.30

Gold—Ounces Per Ton.

		"All-fire" method.
No. 1	2.28	2.42
" 2	1.89	2.10
" 3	2.06	2.18

The Godshall method seems to show a high silver and a low gold result. Whitehead (page 1124) says that his experiments with coppery material have proved that some gold was liable to go into solution when treated with even chemically pure nitric acid. He therefore welcomes the Godshall method. His experience with it shows that excellent results are obtained if the solution is cold and practically free from nitric acid. In order to do

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away with the tedious elimination of nitric acid by evaporation with sulphuric acid, he dilutes the nitric acid solution, makes it faintly alkaline with ammonia, and reacidifies with acetic acid, then adds enough sodium hyposulphite to precipitate 100 mgms. of copper, stirs, boils for five minutes or until the cuprous sulphide collects, filters, scorifies, cupels, etc.

The Colorimetric Assay of Copper. By J. D. A. Smith. *Trans. Am. Inst. Min. Eng.*, **30**, 851–854; discussion by G. L. Heath, 1119–1121.—Referring to the apparatus described by Heath (*J. Am. Chem. Soc.*, **19**, 24) for carrying out the Heine colorimetric assay of copper, the author prefers to do away with preserved sets of standard colors and to make a fresh standard for each batch of assays. The paper describes the method in detail and gives a table of results. Heath defends the use of standards.

INDUSTRIAL CHEMISTRY.

F. H. Thorp, Reviewer.

A Proposed Method for the Extraction of Bromine. By Anson G. Betts. *Eng. Min. J.*, **71**, 783.—Analyses of brines from Midland and Sand Beach, Michigan, and Syracuse, New York, are given, and also the percentage of bromine in the North Atlantic Ocean (0.00635) and in the Dead Sea (0.443). The method proposed is based on the reaction between bromine and phenol, in aqueous solution by which tribromphenol and hydrobromic acid are formed. The bromine must be free and is liberated by the action of chlorine water, but no free chlorine should be present, when the phenol solution is added. The chlorine water and carbolic acid are added three times to precipitate 87.5 per cent. of the total bromine. The reaction takes place instantly, and at ordinary temperatures a precipitate of the tribromphenol appears, if the brine contains as much as 0.002 per cent. of bromine. It was found impossible to precipitate all of the bromine and form hydrochloric acid. Electrolysis is suggested as an advantageous method of setting free bromine; at 5 volts, one horsepower is equivalent to ⅔ lb. of bromine precipitated. If the phenol is pure the precipitate is crystalline and filters easily; if cresole is present, the precipitate is tarry. By drying and heating the precipitate, most of the bromine is recovered as hydrobromic acid; the rest is caught by passing the vapors through an alkali solution, or a solution of ferrous bromide. Reduction of the precipitate by iron and mineral acid will regenerate the phenol, according to the reaction

$$2C_6H_2Br_3(OH) + 3H_2SO_4 + 6Fe = 3FeSO_4 + 3FeBr_2 + 2C_6H_5OH.$$

The process is best carried on by saturating one part of the brine with chlorine and another part with phenol, and then mixing the two portions. Other organic bodies, such as acetylene, are suggested as suitable for recovering bromine from brine.

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Soil Analyses. *Bull. No. 38, N. M. Agr. Expt. Sta. Bull. No. 47, N. D. Agr. Expt. Sta.*

Researches on Nitrocellulose. By G. Lunge. *J. Am. Chem. Soc.*, **23**, 527–579.—This is a long and very complete paper, dealing chiefly with the methods of analysis and the methods of obtaining the various nitrocelluloses. Several illustrations of analytical apparatus are given.

Modern Production of Alum and Aluminium. By J. Ohly. *Min. and Metal.*, **24**, 403–404.—After giving a historical review of the development of the aluminium industry, the author describes a recent French process for purifying bauxite by heating with alkaline sulphides. The iron is converted into ferrous sulphide, but the heat is not sufficient to form aluminates. The fused mass is treated with some sulphuric acid under such conditions that the solution is kept strongly alkaline, while sodium aluminum sulphate is formed and crystallized. The preparation of aluminum hydroxide from this salt is also described. The uses of aluminum as conductors and reducing agent are then considered.

A. H. Gill, Reviewer.

On Fluctuations in the Composition of Natural Gas. By F. C. Phillips. *Proc. Am. Acad.*, **34**, 71–83.—The paper describes an apparatus for the combustion of the gas, samples of from 150–400 cc. being employed, and for the determination of nitrogen in the gas. The per cent. was found to vary from 1.2–3.2 in the same well. No oxygen was found in it. It is possible that the gas occurs liquefied in the rocks, and that the nitrogen is gradually distilled off from it. Attention is called to the fact that it is not easy to prepare from marble, carbon dioxide free from nitrogen. This can be effected with certain marbles, only by boiling them with water for six hours and then transferring them to the generator.

On the Composition of California Petroleum. By C. F. Mabery and E. J. Hudson. *Am. Chem. J.*, **25**, 253–284.—Eight different samples, representing a fair average of the California oils, were examined: a preliminary distillation showed that they could not be distilled without decomposition except *in vacuo* and here the process could be continued to 350° at 50 mm. Analysis showed their chief constituents to be methylenes. All the samples were submitted to fractional distillation *in vacuo*, it being repeated in some cases twenty-four times. The results of the examination of the distillates boiling up to 216° are shown in the table below:

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Fresno Co.	Puente.	Bardsdale.
.....	sp. gr. 20° 0.892	sp. gr. 20° 0.892
.....	% S 0.8	% S 1.5
.....	% N 1.2	% N 1.25
Hexane?	.....	.....
Nonane	.....	.....
Hexamethylene	.....	.....
Heptamethylene	Heptamethylene	Heptamethylene
Octonaphthene	Octonaphthene	Octonaphthene
Nononaphthene	.....	.....
Dekanaphthene	Dekanaphthene	Dekanaphthene
Undekanaphthene	.....	Undekanaphthene
Dodekanaphthene	.....	.....
Benzene	Homologues of	.....
Toluene	benzene	.....
Xylenes	$C_n H_{2n-2}$ series?	Xylenes

Adams Canon.	Torrey wells.	Scott's Hill.
sp. gr. 30° 0.921	sp. gr. 20° 0.884	sp. gr. 20° 0.878
% S 0.9	% S 0.5	% S 0.4
% N 1.46	% N 1.15	% N 1.25
.....	Hexane?	Hexane?
.....	Nonane	.....
.....	Hexamethylene	Hexamethylene
Heptamethylene	Heptamethylene	Heptamethylene
Octonaphthene	Octonaphthene	Octonaphthene
.....	.....	.....
Dekanaphthene	Dekanaphthene	Dekanaphthene
.....	.....	Undekanaphthene
.....	.....	.....
Homologues	.....	.....
of benzene	Toluene	.....

Tri-, tetra-, and pentadekanaphthenes were identified in some of the higher boiling portions. California petroleum contains then a small portion of products boiling below 225° which resemble those in Russian oil; the proportion of aromatic hydrocarbons is, however, larger. It contains only small quantities of substances of the C_nH_{2n+2} series.

On the Composition of Japanese Petroleum. By C. F. Mabery and S. Takano. *Am. Chem. J.*, **25**, 297–307.—The results show that Japanese petroleum is mainly composed of the methylene hydrocarbons. Some contain also solid paraffins and in some the percentage of sulphur and nitrogen is as high as in the California oils.

Composition of Texas Petroleum. By C. F. Mabery. *J. Am. Chem. Soc.*, **23**, 264–267.—The paper gives the analysis of oil from the Lucas gusher. This has a strong odor of hydrogen sulphide, contains 2.16 per cent. of sulphur, and 1 per cent. of nitrogen, and has a specific gravity of 0.92. It seems to contain $C_{14}H_{26}$ and $C_{16}H_{30}$, compounds having perhaps a double polymethylene ring.

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G. W. ROLFE, REVIEWER.

Sugar Beet Investigations in Ohio in 1900. BY A. D. SELBY AND J. W. AMES. *Bull. Ohio Agr. Expt. Sta.*, **126**, 133–174.—This bulletin contains detailed results of an investigation of sugar-beets grown in Ohio and a popular description of Ohio's first factory recently built at Fremont.

Sugar Beets, 1891-1900. *Bull. Expt. Sta. Kans. State Agr. Coll.*, **103**, 253–286.—Tabulated statements of investigations on sugar-beet cultivation are presented, which show that Kansas is unsuited for beet-sugar production.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Improvements in the Metallurgy of Aluminum. BY C. P. TOWNSEND. *Elec. World and Eng.*, **38**, 14–15.—The improvement described refers to two patents (June 25, 1901), by C. M. Hall of an electric fusion method for purifying bauxite. Bauxite, *e. g.*, with alumina, 60 per cent.; ferric oxide, 18 per cent.; silica, 2–3 per cent.; titanic oxide, 3–4 per cent. and water 17 per cent., is calcined, mixed with 8 to 10 per cent. of carbon, held for about one hour in fusion in an electrical furnace having a carbon lining and a carbon electrode; the current can be alternating or direct. Only the impurities are reduced; they collect on the bottom of the bath as a fused alloy, especially in the presence of considerable amounts of iron. In the second method, metallic aluminum or a 50 per cent. ferro-aluminum is substituted wholly or in part for the carbon, to combine with the oxygen of the silica, titanic, and iron oxides; the charge is maintained in fusion for one and one-half hours in the electric furnace, when the impurities will again have separated out. As in this case there is little or no evolution of gas, the fusion is less disturbed than when carbon is used. The elimination of silicon and iron are satisfactory; less so, is that of titanium. The purified alumina differs from that produced by the usual combined dry and wet methods. It is grayish-white, crystalline, has a specific gravity of 3.70 to 3.93, resembles in structure coarse-grained sandstone that is easily crushed, and often friable between the fingers. The product is partly soluble in hydrochloric acid and caustic alkalies with liberation of methane and hydrogen, the former is due probably to aluminum carbide, the latter to the partial reduction of Al_2O_3 to Al_3O_4 or Al_2O.

Discussion of Paper of Mr. Scherr on Reduction Roasting. Its Value for Arsenic Expulsion from Copper Ores and Mattes. BY H. M. HOWE. *School Mines Quart.*, **22**, 381–382.—In his paper (*this Rev.*, **6**, 431) Mr. Scherr held (1) that a metallic ar-

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senate in roasting was decomposed by the joint action of sulphuric anhydride and a weak reducing agent, like sulphur, iron, or copper, the former decomposing the arsenate and the latter reducing the stable arsenic oxide to the volatile arsenious oxide; and (2) that the presence of a powerful deoxidizing agent like charcoal was liable to reduce the sulphuric anhydride and prevent its decomposing metallic arsenate. The author suggests that the reason why the arsenic was not wholly expelled toward the end of the roast was perhaps due to the fact that the ore was not ground sufficiently finely for the sulphuric anhydride to reach the centers of the particles of ore.

Further Notes on Elimination of Impurities from Copper in Refining and Converting. By E. KELLER. *Trans. Am. Inst. Min. Eng.*, 30, 310–314.—In order to approximate as much as possible the slaggability of impurities in refining copper, the author (neglecting the small amounts eliminated by volatilization) adds the impurities in the refined copper to those in the slag and calculates the amounts slagged as percentages of that sum, referring the whole to the unit copper. His figures for the relative slaggability are in per cent.; Cu, 1; Pb, 52.1; Bi, 1.07; Sb, 5.90; As, 5.07; Se, Te, 0.84. Samples of matte and converter-copper from the five blows made at Copper Queen mine show a percentage elimination of: Se, 46.8; Te, 40.0; Ni, 37.0; and Co, 100.

Making Sand Castings of Copper. By C. VICKERS. *Iron Trade Rev.*, *1901*, 34, 17.—When copper is being melted down in a crucible, it absorbs gases and some copper is liable to be oxidized even if the surface be covered with charcoal. The gas makes the copper porous, and the cuprous oxide formed and taken up by the copper makes it brittle. Quite a number of methods have been suggested to diminish the absorption of gas and aid the deoxidation of cuprous oxide. The author gives some details of these.

The Properties of Brass Made from Copper Containing Sub-Oxide, with Observations of the Effect of Oxygen on Copper. By E. S. SPERRY. *Trans. Am. Inst. Min. Eng.*, 30, 837–850. —In poling copper, the reduction of cuprous oxide is not completed in order that traces of bismuth, arsenic, and antimony in the copper shall be present as oxides when they are less harmful than when as metals. Small amounts of cuprous oxide are liable to make copper somewhat cold-short, but not hot-short, hence the metal is rough-rolled hot and finished cold. In making brass, some of the zinc is oxidized at the expense of the metallic oxides contained in the copper. In the experiments made to see what effect the oxygen of the copper had in brass-making, the copper used was oxidized by exposing it when melted to air; analyses gave from 1.12 to 1.52 per cent. oxygen. Oxidation with niter proved

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unsuccessful. The base-composition of the brass used was copper 60 per cent. and zinc 40 per cent. The experiments show that the amounts of oxygen usually contained in commercial copper (0.010 to 0.012 per cent.) have no harmful effect on the quality of brass intended for rolling into sheets, the oxygen may reach even 0.55 per cent. and does no harm if special care be taken. An excessive amount of oxygen causes the formation of a salamander, a mixture of infusible zinc oxide and copper. If oxygen is present in not sufficient amount to form a salamander, but above 0.55 per cent., the brass will show a tendency to crack, due to the presence of zinc oxide.

Note on the Plate-Amalgamation of Gold and Silver. By E. A. H. Tays. *Trans. Am. Inst. Min. Eng.*, 30, 318–320.—In a former paper (*Trans.*, 29, 776); the author gave some data on the milling of silver-bearing gold ore of the Anglo-Mexican Gold Mining Company, San José de Gracia, Sinaloa, Mexico, in the Bryan roller quartz-mill. He now supplements them by figures obtained from the same kind of ore with the stamp battery. The ore stamped assayed gold 0.76 oz. and silver 0.71 oz., the tailings 0.22 and 0.27 oz. per ton, showing an extraction of 0.54 and 0.27 oz. or 71.7 and 39.4 per cent. Based on the assays, the extraction should be 2 : 1 ; the average fineness of the bullion, however, gave a ratio of 2.74 : 1. In the Bryan mill the ratio of gold to silver recovered was 2.34 : 1.

Gold Ores in the Black Hills, South Dakota. By H. M. Chance. *Trans. Am. Inst. Min. Eng.*, 30, 278–285.—The silicious gold-belt in the vicinity of Deadwood and Lead City covers an area 6–7 miles in length and 3–4 miles in width, and is 300–400 feet thick. It has ore-chutes and ore-horizons scattered through it which give an average value of $12.00–$18.00 per ton. The ore is mined at a cost of not over $4.00 per ton ; it is treated by raw- and pyritic-smelting at a cost of $4.75–$5.75 per ton, by barrel-chlorination for $3.50–$4.50 per ton, and by cyaniding for $3.00–$3.75 per ton. The second class of deposit comprises the free milling ores occurring as steep veins in metamorphosed rocks ; the bulk of the gold is extracted by battery amalgamation, the rest by concentrating the tailings and leaching with potassium cyanide.

Pyritic Smelting in the Black Hills. By F. R. Carpenter. *Trans. Am. Inst. Min. Eng.*, 30, 764–778, 1128.—The author uses the term pyritic smelting in the same manner as Percy; *viz.*, smelting dry silver-ores in connection with iron pyrites to form a matte. He places on record his successful work in smelting the ores of the silicious gold-beltnear Deadwood, South Dakota. In his practice he followed in general the work of Mansfeld, Germany, in that he made slags ranging between 4RO, $3SiO_2$ and

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RO, SiO_2—RO being mainly lime and magnesia, FeO playing a minor rôle. The matte-fall rarely exceeded 5 per cent. Iron sows formed in the operation, and these helped to carry down the gold, so that clean slags could be made in the absence of copper which has always been considered essential if waste slag free from precious metal is to be produced. The refining of the matte was at first accomplished by treating with lead ores; here it was found that matte as well as iron sows readily gave up their gold to the lead, while the extraction with silver was not so perfect. A second method outlined by the author is to smelt the matte for copper bottoms which, being granulated, oxidized and resmelted with sulphur-bearing material, would give a second bottom very much richer than the first. In order to have a perfect concentration it is essential that some lead is present. The bottom from the second selecting is so rich in lead that it can be cupelled, often directly without the addition of lead, six parts lead to one of copper giving satisfactory results. The first bottoms can be smelted directly with sulphur-bearing material without granulating and oxidizing, and the operation repeated until the concentration has reached the desired degree.

Furman (*op. cit.*, 1125), in discussing the paper, states that he believes that alumina always ought to be figured as replacing silica and gives some experience of his in smelting peculiar lead ores, when he found the most suitable slag to be SiO_2, 28; Fe(Mn)O, 36; CaO, 16; and Al_2O_3, 14 per cent. He further attacks the practice of making iron sows and suggests that the addition of pyritic and coppery material would have obviated it.

Carpenter defends his practice and gives new evidence of its correctness by citing the leading facts of the work he did along similar lines in Colorado in smelting Cripple Creek ores. He shows how important it is to distinguish between formation temperature and fluidity of slag, the former having proved in his first work in Colorado to have been so low that the slag would not run. As to Furman's suggestion of adding sulphurous material to the charges to prevent the formation of sows, the author shows how it is that this would, on the contrary, have aggravated the trouble.

The Union Gold Extraction Company's Mill at Florence, Colorado. By J. E. Rothwell. *Eng. Min. J.*, 71, 721–724.—In this mill, which has a capacity of 400 tons ore per day and is built to do custom work, the gold from Cripple Creek is extracted by means of barrel-chlorination. The mill is described under the following heads: Sampling, storage and purchase of the ore; drying and fine-crushing; roasting and cooling; chlorination and precipitation; roasting, melting and refining; concentration, power plant and water supply system; assay office, laboratory. For details the reader is referred to the original.

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Chlorination Mills at Cripple Creek, Colorado. The Methods Used in Handling the Ore and the Application of the Process. By A. Lakes. *Mines and Minerals*, **21**, 337–339.—This article is a general one with some good photographic reproductions; some details are given of the Economic Chlorination Mill.

Cyaniding Stamp Mill Tailings in Western America. A Description of the Dexter Gold Mining Company's Plant at Tuscarora, Nev. By W. Magenau. *Mines and Minerals*, **21**, 299–301.—The plant treats the tailings from the forty-stamp mill which crushes daily 102 tons silicious ore containing 85 per cent. silica, and 10 per cent. iron. On account of clayey seams in the ore as much as 5 gallons of water per stamp per minute is required in stamping. The mill tailings are raised by a bucket elevator and run into three iron settlers (12 feet deep and 18 feet in diameter), supplied with Butters and Mein automatic revolving distributors. Fifty-two tons of sands ($1.57 gold and $1.70 silver per ton) are separated per day from slimes ($3.19 gold and $5.03 silver per ton) which overflow into an annular trough and are collected in two artificial ponds. The bottom of a settler has a gravel filter and two 18-inch discharge-holes closed with hollow sheet iron plugs. One settler is being filled while the second is drained and the third emptied. Draining is accomplished on the inner side by a vertical box (10 × 4 inches and 12 feet long closed on one side with old battery screens) and on the bottom by four drainage pipes. A settler catches 51 per cent. of the material fed into it. The sands are discharged into cars beneath by shoveling and trammed to the leaching department. This contains 14 tanks (10 of 20, and 4 of 50 tons' capacity). The filter is a false bottom of 1-inch boards with $\frac{3}{8}$-inch holes, it rests on slats, 1 × 1 inch placed 8 inches apart, and is covered with 10-oz. canvas. The method of leaching is that of continuous percolation, a stream $\frac{1}{2}$ inch in diameter flowing from the 2-inch discharge pipe. The cyanide consumed, $1\frac{1}{2}$ lbs. per ton treated, is replaced by feeding the necessary amount into a perforated tin box, resting on the top of a newly-charged tank, and allowing the fresh solution to play upon it in such a way that all the cyanide will be dissolved when the ore is submerged. The ore is leached in from three to five days and receives one wash-water (1 ton water to 4 tons ore) after the solution has been drained off. The leached tailings are sluiced out by water passing through a 2-inch hose with $\frac{1}{2}$-inch nozzle under a pressure of 60 pounds; one man sluices out 50 tons in $1\frac{1}{2}$ hours.

The gold is precipitated in ten rows of boxes, each having ten compartments 12″ × 12″ × 10″. The solution, flowing at a rate of 3.1 tons per hour, contains when entering 0.97 oz. silver and 0.082 oz. gold per ton, and when leaving 0.10 oz. silver and 0.01 oz. gold which represents a saving of 88.7 per cent. The dried

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precipitate (containing gold 3.31 per cent., silver 70.16 per cent., zinc 9.76 per cent., iron 1.45 per cent., lead 1.40 per cent., silica 6.48 per cent., n. d. 7.44 per cent.) is sold to lead smelters. The solution when titrated with silver nitrate without an indicator gives 4 lbs. potassium cyanide per ton; its alkalinity is equivalent to 0.16 per cent. H_2SO_4. The slimes of a pond, when filled, are allowed to dry. When the upper two or three feet have become well baked in the arid climate they are removed, brought to the leaching mill and charged with alternate layers of sands into the leaching vats and worked in the same way as the sands. The average extraction is 66.8 per cent. gold and 37.7 per cent. silver or 51.7 per cent. of the total values. The labor required is one foreman, one car-man, two shovelers, one night solution-tender, the foreman doing this work during the day.

Cyaniding Cupriferous Ores. By L. Janin. *Eng. Min. J.*, 72, 197.—The oxidized gold ores of the Lydenburg district, Transvaal, are composed of quartz, oxides of iron, dolomite and contain besides the gold, small quantities of manganese, bismuth, silica, and copper. In the cyanide treatment manganese dissolves only when an insufficient amount of lime is used, bismuth presents no difficulties, 10 per cent. silver or less is recovered. The copper of the ore amounts to 0.4 per cent. and is present in different forms, metallic copper collecting on the amalgamating plates and of the rest only a small portion being dissolved by the cyanide, forming potassium cuprocyanide, $3KCy,CuCy$. The only method of removing the copper was to treat the ore with the cyanide solution obtained in ordinary practice containing cuprocyanide, but no free cyanide. This solution would dissolve the copper and, after having been freed from it again by the Siemens-Halske electrolytic method of precipitating, would be used over again.

The Quicksilver Mines of Brewster County, Texas. By E. P. Spalding. *Eng. Min. J.*, 71, 749–750.—The only company in this promising district, described in detail, that is treating the cinnabar ores, is the Marfa and Mariposa Mining Company. It has in operation a 10-ton Hüttner-Scott furnace. The ore, crushed to ½-inch, is charged hourly by a car holding 900 lbs. and every half-hour half a car of spent ore is withdrawn below. It takes the ore about twenty-four hours to pass through the furnace in which time from 1¼–1½ cords of wood are burned on the grate. The fumes leaving the furnace through a 16-inch sheet-iron pipe zigzag through six condensers, each with a partition wall, before they pass through a long flue into the air. The condensers are dry on account of the scarcity of water. Most of the quicksilver collects in the first three chambers which are freed from soot weekly, while the others have to be cleaned up only once a month. The condensed quicksilver runs off continuously into a storage tank to be bottled. The soot is freed from a large

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part of its quicksilver by working on an inclined plane, when it is added in small amounts to the ore charge. The yield in quicksilver is estimated to be 90 per cent. In five months 1200 flasks of quicksilver were produced.

Blast-Furnace Gases in Gas-Engines. By J. W. Richards. *J. Franklin Inst.*, **150**, 415-430; *Iron Trade Rev.*, **33**, Dec. 13, 20, 1900.—The author briefly reviews the beginnings and the present use of iron blast-furnace gases in gas-engines. He then calculates from three examples of gas—poor, average and rich—the surplus horse-power that can be obtained if the gases are burned directly in gas-engines or first under boilers to drive steam-engines, and shows what great advantages the former have over the latter.

The Protection of Blast-Furnace Linings. By S. S. Hartranft. *Trans. Am. Inst. Min. Eng.*, 30, 573–577.—While furnacemen take the necessary precautions to protect the hearth and bosh of an iron blast-furnace beyond the life of the lining of the shaft, the portion of the lining above the mantle-plate has been more or less neglected. The author proposes to secure this part by introducing water-cooled plates which shall reach with their front edges to within from 9 to 12 inches from the inside of the brickwork. This will permit an enlargement of diameter of from 18 to 20 inches without endangering the plates and a longer blast of regular work than is the case now.

A Peculiar Silicious Efflorescence upon Pig Iron. By B. F. Fackenthal. *Trans. Am. Inst. Min. Eng.*, **30**, 524–528.—At Durham furnace, while making Bessemer iron low in silicon, it was found that when the pigs were broken hot from the sow an efflorescence was found to exude from the fractures in the form of small globules and thin sheets. An analysis of the efflorescence gave the following figures:

	Per cent.	Per cent.
Silica	94.87	97.67
Oxide of iron	0.98	1.01
Oxide of manganese	0.25	0.26
Lime	None	None
Magnesia	None	None
Titanic acid	0.95	0.98
Loss on ignition	2.87	....
Total	99.92	99.92

The loss by ignition in the second analysis is principally graphite. A microscopic examination showed the material to have a radial fibrous structure, besides there were found occasional cubical crystals of titanium carbide and some minute hexagonal crystals believed to be graphite. The paper gives the details of the blast-furnace working at that period and an analysis of cadmia that had formed.

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Howe (*op. cit.*, 118), in discussing the paper, believes the silicious efflorescence may have been due to the eliquation of a zinc or lead silicide which, held in solution by the cast iron in the blast-furnace, would upon removal of the gas or vapor-pressure of the furnace quickly be volatilized and at the same time oxidized.

The Foundry of the General Electric Company at Schenectady, N. Y. By C. L. PRINCE. *J. Am. Foundrymen's Assoc.*, **9**, (1), 83–95.—An illustrated description, rather general in its character.

Shot Iron, How to Recover It, and How to Use It. By C. H. PUTNAM. *J. Am. Foundrymen's Assoc.*, **9**, (1) 101–104, (2) 71–75, (3) 15–16.—In well-equipped foundries the cinder from the cupola is usually crushed in a tumbler and the shot separated from the pulverized cinder. The author goes farther in that he passes the pulverized cinder over a magnetic separator and thus saves additional iron; he recovers daily from the dump of two cupolas 550 lbs. siftings which give 450 lbs. strongly mottled iron after melting. This iron has got to be worked in with the regular cupola charge, the amounts to be found by experiment. The daily saving by the combined crushing and magnetic separation with two cupolas amount to $3.00.

Anthracite as a Cupola Fuel. By E. KIRK. *The Foundry*, **18**, 111–114.—The use of anthracite as a cupola fuel is limited on account of the smallness of the anthracite fields, the leading ones occurring in four counties of eastern Pennsylvania. While in this region formerly anthracite was the sole cupola fuel, it has been greatly superseded by coke, a mixture of the two giving most satisfactory results. The paper contains tables giving the complete records of a number of foundings using anthracite and mixed anthracite and coke.

The Grading of Casting. REPORT BY THOS. D. WEST AND R. MOLDENKE. *J. Am. Foundrymen's Assoc.*, June, 1901.—The authors suggest that, in grading, the percentages of silicon and sulphur should show the following range:

	Per cent.	Per cent.
No. 1	2.50 to 3.00	0.03 maximum or under.
No. 2x	2.00 to 2.50	0.03 " " "
No. 2 soft	2.50 to 3.00	0.04 " " "
No. 2 plain	2.00 to 2.50	0.05 " " "
No. 2 strong	1.50 to 2.00	0.05 " " "
No. 3	1.50 to 2.50	0.10 to 0.05
Etc.	Etc.	Etc.

Fracture Indicates Quality. By E. A. MAYNE. *The Foundry*, **18**, 123–124.—This note is the plea of a foundry man for the use of a little common sense in the judging of the quality of pig iron.

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It appears that the earnest and just protest against judging pig iron by fracture is being used by unscrupulous people in palming off all sorts of stuff on the foundrymen on the strength of a so-called chemical analysis.

Foundry Iron. By C. Henning. *J. Am. Foundrymen's Assoc.*, 9 (1), 121–124.—The author attributes most of the difficulties encountered by foundrymen to the variation in the composition of the pig iron. He has always had successful casts with iron having the following range of composition: total carbon, 3.50–3.75; combined carbon, 0.27–0.52; Si, 2.62–3.22; Mn, 0.98–1.18; P, 0.60; S, 0.03; Cu, 0.02; that is, the impurities ranged from 7.50–8.10 per cent., and the iron did not run lower than 92.475 per cent. Whenever the amount of impurities exceeded 8 per cent. or a determination gave a lower figure for iron than 92 per cent., the castings would be porous and weak.

The Influence of Silicon and Sulphur on the Condition of Carbon in Cast Iron. By H. M. Howe. *Trans. Am. Inst. Min. Eng.*, 30, 719–733.—In recent publications data have been given which seem to show that the percentage of graphite in cast iron is independent of the amount of silicon present. The author attributes this belief to a wrong interpretation of the evidence. He shows that the graphite-content in normal and relatively pure commercial pig iron is influenced only indirectly by the percentage of silicon, in that silicon lowers the solvent power of iron for carbon, and thus lessens the proportion of combined carbon and increases that of graphite, provided the total carbon remains constant; the decrease of combined carbon is rapid at first, especially as the silicon rises from zero to 0.75 per cent., and then slower and slower; the influence of silicon is often masked by that of other variables. Sulphur is known to raise the saturation point of cast iron for carbon; by increasing the combined carbon-content, it lowers the graphite-content. It is estimated that the proportion of combined carbon in pig iron is increased 0.02 per cent. for each 0.01 per cent. increase in sulphur when the iron contains 1–2 per cent. Si, and 0.03 per cent. for each 0.01 per cent. S, when the iron contains 2–3 per cent. Si.

The Microstructure and Physical Properties of Cast Iron, as Affected by Heat Treatment, Especially in the Manufacture of Malleable Cast Iron. By A. T. Child and W. P. Heineken. *Trans. Am. Inst. Min. Eng.*, 30, 734–759.—In the experiments, of which the paper is a record, white and gray cast iron bars 0.5 inch thick, and 18 inches long were packed in iron oxide and annealed for from ten to forty days at a temperature of about 950° C. Microphotographs and tension tests of the original and the annealed bars show the changes which take place in the process. In general, the cement carbon of a bar breaks down in the

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process to temper carbon; this is oxidized, while the graphite is only very slowly attacked, hence the original cast iron must contain much cement carbon, that is, it must run low in silicon. If the casting is high in silicon, there remains much graphite; such an iron requires a very long time for annealing, and gives, being imperfect, a weak porous product. The details of the experiments can be discussed only in connection with the micrographs (of which there are 30), the cooling curves (13 in number), and the table of mechanical tests.

The Chemistry and Physics of Cast Iron. A continued discusssion by H. M. HOWE, OUTERBRIDGE, W. R. WEBSTER, AND A. W. WHITNEY. *J. Franklin Inst.*, **150**, 329–355.—Excellent reproductions of fractures of castings accompany the discussion.

The Annealing of White Cast Iron. BY C. JAMES. *J. Franklin Inst.*, **150**, 227–234; *Foundry*, **17**, 270–274.—The author, who is a manufacturer of malleable castings, has embodied in this paper some leading facts relating to the chemistry of annealing. Only Bessemer pig iron is used at his works; the furnace charges consist of mixtures of gray irons (combined carbon, 0.50; graphitic carbon, 3.50; Si, 1.30; Mn, 0.30; S, 0.02; P, 0.08), and of scrap from previous operations, the whole being made up to contain: C, 3.40–3.80; Si, 0.90–1.20; Mn, 0.35–0.20; S, 0.05–0.04; P, 0.04–0.03. The charges are melted occasionally in the cupola, but generally in a reverberatory furnace holding from 3 to 5 tons of metal. A furnace is brought to nearly the melting-point of the iron before it is charged. This will cause the iron to melt down in from three and a quarter to three and three-quarters of an hour; it is then rabbled and fined for from thirty to forty minutes, when a test-piece 8 inches long and 1¼ inches in diameter, rapidly cooled (when it has solidified) and broken, will show that apparently all the graphite has disappeared; the casting, made from the iron, will however show a little graphite which rarely exceeds 1.5 per cent., an average of a number of such castings giving: Combined carbon, 3.02; graphite carbon, 0.47; Si, 0.78; Mn, 0.12; S, 0.05; P, 0.04. The charges of the annealing furnace weigh from 2 to 3 tons, large castings are placed in the open furnace, small ones are packed in covered boxes of cast iron or wrought iron; the only difference between the two after annealing is that the former show more scale. The reason that castings when heated in the open furnace are not annealed more quickly than when packed, is that in the iron boxes annealing still goes on while the furnace is being cooled off, while, of course, this is not the case with open castings. The weight of the castings to be annealed shows a range of from 0.5 ounce to 2000 pounds; the time required varies accordingly from three and one-half to ten hours after the castings have attained the full temperature which

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is about 1010° C. The temperatures at which change of carbon from the combined (cement carbon) to non-combined (temper carbon) state takes place varies somewhat with the composition of the iron and is closely related to its melting-point, and this again is governed by the relative amounts of carbon, silicon, manganese and sulphur. The following two analyses give the changes of the form of carbon in annealing.

Annealing.	Combined carbon.	Temper carbon.	Si.	Mn.	S.	P.
Before	2.60	0.72	0.71	0.110	0.045	0.039
After	0.82	2.75	0.73	0.108	0.04	0.039

As to the effect of impurities, the author finds that phosphorus has none, while the reverse holds good for silicon and manganese; investigations as to the influence of sulphur are still in progress. Irons low in silicon and manganese are practically worthless after annealing, as shown by the following analyses of annealed castings:

Combined carbon.	Temper carbon.	Si.	Mn.
2.65	none	0.46	trace
1.97	none	0.42	trace

Iron high in these two elements works well, *viz.*:

Annealing.	Combined carbon.	Temper carbon.	Si.	Mn.
Before	1.94	none	0.64	0.09
After	none	2.00	0.62	0.110

Thus, silicon forces the carbon to change its condition and manganese protects the silicon from oxidation.

The Cupola Practice in the Bessemer Steel Works. By S. M. Rogers. *J. Am. Foundrymen's Assoc.*, **9**, (1) 40–46.—The cupola of a Bessemer plant differs only in a few details from that of a foundry in that it has to run continuously for a longer period. Thus it is important that the crucible walls up to the boshes shall be not less than 24 to 26 inches thick; the tuyères are also placed higher than with the foundry cupola, as the crucible has to hold a larger amount of metal. The number and size of tuyères depends upon the size of the furnace; about 30,000 cubic feet of air are required to melt 1 ton of iron; a furnace with a 4-foot crucible and a 5-foot bosh will contain 48–50 tuyères in two rows, the tuyères being 4 inches in diameter on the outside and tapering to 2½ inches on the inside; the area of the tuyères should be at least 2½ times as great as that of the bustle-pipe. The pressure used shows a range of from 4 to 7 ounces per square inch; if the pressure be higher, iron is liable to be oxidized and the slag to foam. In order to flux the coke ash, adhering sand, etc., forming an acid slag, from 35 to 40 pounds of limestone are added per ton of iron. The cupola under favorable conditions will run continuously for a week; the life will

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be shortened if the iron contains much manganese. In regular work it frequently happens that there is some delay in the converting; in such cases the work of the cupola has to be held back. If the delay lasts longer than six to eight hours, the contents of the cupola will have to be dropped.

Further Notes on the Bertrand-Thiel Process. By J. Hartshorne. *Trans. Am. Inst. Min. Eng.*, **30**, 531–536.—Since the last report on this process by the author (*this Rev.*, **6**, 56), the main development has been in the direction of using direct metal from the blast-furnace. The furnace has also been enlarged. The charge consists now of 80 per cent. liquid pig, 10 per cent. cold pig, 2 per cent. old rolls, 8 per cent. scrap, with about 93.6 per cent. iron; four heats are made per furnace per day, and the yield in clean ingots is 98.4 per cent. See also Howe (*The Mineral Industry*, **8**, 378).

The "Talbot" Continuous Open-Hearth Process. By H. W. Lash. *Iron Trade Rev.*, 1901, **34**, Feb. 28, p. 14. The paper discusses the production of steel by the Bessemer and the ordinary and the Talbot basic open-hearth processes. It appears that in due time the Bessemer will have to yield to the basic open-hearth process which already now produces at the same cost a higher grade steel from a cheaper pig; its disadvantages are that it requires from five to six times the yard space of a Bessemer plant and delivers the steel with less regularity and in larger units. During the last six months the Talbot process, in operation at the Pencoyd Iron Works near Philadelphia, has produced regularly 107 tons steel and scrap for every 100 tons of pig charged, the large excess being due to the better reduction of iron from iron oxide charged and the better protection of the metal from oxidation. The paper gives a horizontal and vertical cross-section through a Talbot open-hearth plant with two 200-ton furnaces. With each cast 20 per cent. of refined metal is removed and replaced by 40 tons of unrefined metal either direct from a blast-furnace or a mixer. As 10 casts are made in twenty-four hours, the capacity of the plant is 400 tons steel per day. The relative costs of Bessemerizing and producing steel by the Talbot process are shown in the subjoined estimates:

Bessemer Process.

100 tons of pig iron at $12.00 per ton	$1,200.00
1 ton of ferromanganese at $60.00 per ton	60.00
	$1,260.00
Product 90 tons of ingots and scrap. Cost of raw material per ton of ingots produced	$ 14.00

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TALBOT PROCESS.

110 tons of pig iron at $12.00 per ton	$1,200.00
30 tons of ore, mill cinder and scale, at $4 per ton	120.00
9 tons of limestone, at 70c per ton	6.30
Fluorspar, manganese, ore, etc.	8.00
½ ton ferromanganese, at $60.00 per ton	30.00
	$1,364.30
Product 107 tons of ingots and scrap. Cost of raw material per ton of ingots produced	$ 12.75

This presupposes that the cost of the pig in both cases is the same, while in reality phosphoric pig is cheaper than Bessemer pig. The advantages of the Talbot over the ordinary basic open-hearth process are: 1. The delivery of hot ingots to the blooming mill furnace with more regularity; 2. A saving of 25 per cent. to 30 per cent. in first cost of plant; 3. Only one-third of the space is required for a given capacity; 4. Twenty per cent. less fuel is required per ton of ingots produced; 5. The labor per ton is less than one-half, and the yield is greater than ever reached by any other process.

APPARATUS.

A. H. GILL, REVIEWER.

Improvement in Orsat Apparatus. BY A. BEMENT. *J. Am. Chem. Soc.*, **23**, 57.—The "improvement" consists in the introduction of a glass disk to hold up the glass tubes in the pipettes. The abstractor recollects having seen fourteen years ago, a wire support for this purpose, which has been in use ever since.

An Automatic Filter Washer. BY J. M. PICKEL. *J. Am. Chem. Soc.*, **23**, 589–593.—The apparatus, which is especially designed for the determination of the water-soluble content of fertilizers, cannot well be understood without the figure. It would seem to be admirably adapted for its purpose.

An Easily Constructed Barometer. BY G. W. RUSSELL. *Am. Chem. J.*, **25**, 508–510.—This article describes an easy method of preparing a siphon barometer.

A New Coal Calorimeter. BY S. W. PARR. *J. Am. Chem. Soc.*, **22**, 646–652.—This instrument uses the principle of the L. Thompson calorimeter, that of burning the coal by the use of some chemical, sodium peroxide in this case. This has the very important advantage that it absorbs the products of combustion, thus preventing loss of heat from this cause. Results obtained varied by less than 0.8 per cent. from those of the bomb calorimeter.

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Improved Electric Furnace for Laboratory Use. By S. A. Tucker and H. R. Moody. *J. Am. Chem. Soc.*, **23**, 473–476.—The improvement consists in the use of carbon bricks luted with graphite paste instead of the chalk blocks of the Moissan furnace. One inch electrodes pass in through clay or asbestos cylinders. The size of the furnaces in the clear was $6 \times 4 \times 2$ inches. Currents of 300 amperes at 70 volts were used.

An Apparatus for Determining Fat. By H. J. Wheeler and B. L. Hartwell. *J. Am. Chem. Soc.*, **23**, 338–343.—The apparatus, which is illustrated by a figure, consists of a battery of ten improved Knorr extractors. The improvements consist in part in the use of an ordinary flask and of a smaller quantity of dry ether, and in an arrangement serving to recover the ether.

Pharmacist's Apparatus Stand. By J. P. Remington. *Am. J. Pharm.*, **73**, 19–20. This stand consists of a pair of vertical supports carrying horizontal bars upon which the rings, burette clamps, etc., may be fastened.

The Use of Acetylene Gas as Fuel in Chemical Laboratories. By Arthur Lachman. *Am. Chem. J.*, **24**, 39–45.—The conclusions are that it does not pay to use acetylene as a laboratory fuel in place of gasolene gas. Although the cost of an acetylene equipment is less, the generator requires more than twelve times the attention, the gas must be purified from phosphine, and the flame cannot be regulated with sufficient accuracy for delicate work, such as the heating of thermostats; moreover a luminous jet deposits a large quantity of soot. The heat of combustion of gasolene gas is almost twice that of acetylene, and the cost about one-half: it would seem therefore inadvisable to use it from the standpoints of either cost, convenience, or practicability.

Apparatus for Generating Gases at Constant Flow and of High Efficiency. By G. A. Koenig. *Am. Chem. J.*, **24**, 373–7.—The apparatus, which is illustrated by a figure, provides for the heating of the generating vessel to about 80°. This insures a constant current of gas (of sulphuretted hydrogen or chlorine). It is also so arranged that the acid necessary for the generation be added in successive small portions, thus preventing waste. It seems to be novel and efficient.

A Modification of the Bunsen Vacuum Pump. By M. H. Ittner. *Am. Chem. J.*, **24**, 253–5.—The pump consists of a reservoir to provide a constant heat of air-free water, which is discharged through a jet into a bulb imparting a vertex motion to the water passing down the fall tube. The exhaust tube is taken off at such a point as almost to preclude the possibility of water striking back into the vessel evacuated.

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A Multiple Fat Extractor. By C. L. Penny. *Am. Chem. J.*, **24**, 242–249.—The apparatus, which acts upon the Soxhlet principle, is constructed of metal, and permits of the extraction of 51 samples of milk, in capsules, at one time. These capsules are of tin-foil, and are 2 inches in diameter and $\frac{5}{8}$ of an inch deep. They are such as are used for capping salt-mouth bottles. Asbestos or coarse sand is used as an absorbent for cream. When the milk residue has dried, the capsules are packed vertically on the edge of the cylinder, and submitted to the action of the petroleum ether. No trace of mechanical loss has been observed when the racks used to hold the capsules fitted properly.

Two Devices for Circulating Liquids at Constant Temperature. By I. H. Derby. *J. Phys. Chem.*, **5**, 17–20.—One consists of a centrifugal pump in glass, the suction-pipe being at the top of the liquid and forcing it through a jacket of constant temperature to the bottom of the liquid. This has the disadvantage that the circulation may be insufficient. The other makes use of the Witt's stirrer, instead of the centrifugal pump above mentioned. This insures a thorough circulation of the liquid in the bath.

Electric Furnaces for the 110-Volt Circuit. By Nevil Monroe Hopkins. *J. Am. Chem. Soc.*, **20**, 769–773.—Two furnaces for laboratory use are described and illustrated by figures. One consists of three pairs of arc light carbons, which are inserted in an iron vessel lined with fire-brick, and are so connected that the three arc gaps are in series with one another, whereby it is made possible to reduce the external resistance necessary. This furnace may serve for preparing calcium carbide. The other furnace is smaller and has no special characteristics.

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